

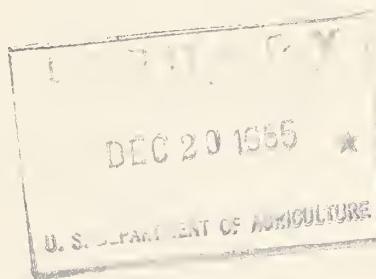
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ABSTRACTS of RECENT PUBLISHED MATERIAL on Soil and Water Conservation



UNITED STATES DEPARTMENT OF AGRICULTURE

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Authors of articles and reports in the field of soil and water conservation are urged to supply abstracts, reprints, or copies to J. H. Stallings.

Soil and Water Conservation Research Branch
Agricultural Research Service
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Plant Industry Station
Beltsville, Md.

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SOIL SCIENCE (BASIC)

Soil Physics

THE LIQUID-VAPOR INTERFACE IN THE IDEAL SOIL

By W. Gardner and J. H. Gardner. *Soil Sci.* 76: 135-142. 1953.

The purpose of this paper is to consider geometric features of the liquid-vapor interface in a soil composed of uniform spheres. It is shown, in particular, that the volume of the water at the point of contact of two spheres is determined by a scalar quantity representing the ratio of one of the two radii of curvature of the liquid-vapor interface to the radius of the sphere.

CAPILLARY CONDUCTIVITY VALUES FROM MOISTURE YIELD AND TENSION MEASUREMENTS ON SOIL COLUMNS

By S. J. Richards and L. V. Weeks. *Soil Sci. Soc. Amer. Proc.* 17: 206-209. 1953.

Water yield values are given for 35-cm. columns of two soil types. Three to four surface cm. of water were withdrawn from the columns in periods of about a week, using 900 cm. of water tension. Simultaneous tension values are given for four locations along the column during wetting and drying period. Some effects of preparing the disturbed soil samples and of length of soil column are indicated.

A method is suggested for calculating capillary conductivity by the use of data obtained during transient changes of moisture content and tension in a soil column. Although the method is not precise, conductivity values are obtained with less

complicated equipment and in a shorter time than is possible by the use of previously described methods. Capillary conductivity values seem to vary with tension independent of tension gradients.

WATER ENTRY AND DOWNWARD MOVEMENT IN UNDISTURBED SOIL CORES

By S. A. Taylor and N. C. Heuser. *Soil Sci. Soc. Amer. Proc.* 17: 195-201. 1953.

Water moves downward in a dry soil from a constant source at the surface, according to Darcy's law, which, combined with the law of conservation of mass, results in an equation for the downward flow of water in unsaturated soils. This equation has previously been discussed and solved for special conditions. Paper reports progress that has been made in measuring and evaluating the components of this equation for undisturbed soil cores.

Six undisturbed cores 10 cm. in diameter and 120 cm. long and containing different amounts of water were used. Water was allowed to enter the core under a constant head of 1.2 cm. the quantity of water that accumulated in the soil and the depth to the wetting front were measured as functions of time. The soil moisture potential was measured at 5 cm. intervals of depth and at various time intervals. From these measurements infiltration rates, moisture potential gradients, and apparent moisture conductivities were calculated. Moisture conductivity was calculated from the moisture-retention curve as suggested by Childs and Collis-George; this technique has not been experimentally verified sufficiently to justify the calculation of the conductivity

gradient, hence the flow equation has not been completely solved.

The results indicate that the infiltration rate depends primarily on the gradient of the moisture potential and has secondary dependence on the capillary conductivity. Potential gradients in the wetting zone and across the wetting front may be much greater than in the transmission zone and they appear to be a principal factor in determining infiltration rates. Potential gradients were measured and used to calculate apparent capillary conductivity values which are always smaller than infiltration rates. As a result of large potential gradients, the infiltration rates exceeded the saturated permeability in five of the six cores studied.

THE APPLICATION OF THE GOUY THEORY TO SOIL WATER SYSTEMS

By G. H. Bolt and M. Peech. *Soil Sci. Soc. Amer. Proc.* 17: 210-213. 1953.

This paper shows how the Gouy theory may be used to describe the properties of soil and clay suspensions. The volume charge density and the potential distribution in a single layer may be calculated for widely different clay suspensions if the surface density of charge and the concentration of free electrolyte are known. The interaction between two diffuse double layers of adjacent particles leads to a differential equation describing the volume charge and potential distribution that can be solved only for suspensions containing symmetric electrolytes. Sufficiently accurate approximations of the charge and potential distribution may be made, however, for suspensions containing asymmetric electrolytes. Due consideration must be given to the specific adsorption potential of ions in the Stern layer.

By means of the Gouy theory it is possible to calculate such measurable quantities as negative adsorption, osmotic pressure, and membrane potential. Comparing the applicability of the Donnan and the Gouy theories shows that the Gouy theory is superior in describing and predicting the properties of deflocculated clay suspension. Indeed, the application of the Donnan theory to such systems leads to serious errors.

DIFFUSION OF ETHYLENE BROMIDE IN SOILS

By W. J. Hanson and R. W. Nex. *Soil Sci.* 76: 209-214. 1953.

The effect of a number of factors on the diffusion of ethylene dibromide in soil was studied. Porosity, or total gas space, was found to be the most important.

FIELD CAPACITY IN LABORATORY COLUMNS

By R. D. Miller and J. L. McMurtrie. *Soil Sci. Soc. Amer. Proc.* 17: 191-195. 1953.

It is shown that the material decrease in downward movement of water, observed as soils approach field capacity, cannot be explained in terms of capillary conductivity alone. Instead, the combined effects of decreasing capillary conductivity in the drying zone, hysteresis and reduced hydraulic gradients at all levels are involved. The capillary conductivity of the drying zone is always greater (probably much greater) than that of the wetting zone. Hysteresis effects, if present, ought to result in larger reductions in hydraulic gradient for an increment of water transfer than would occur without hysteresis.

The hydraulic gradients at all levels ought to decline during drainage. Experimental evidence is presented which is in general agreement with expectations. Hysteresis effects were large, and the hydraulic gradients greatly diminished after 48 hours of drainage.

A DIFFUSION-EQUILIBRIUM METHOD FOR OBTAINING SOIL GASES UNDER FIELD CONDITIONS

By G. S. Taylor and J. H. Abrahams. *Soil Sci. Soc. Amer. Proc.* 17: 201-206. 1953.

A soil gas sample obtained by mass flow of gases may not be representative of the point sampled because of mixing with gases from other soil depths or from the atmosphere. A method was investigated which eliminates this error and which is based on the diffusion of gases between a point in the soil to a collection chamber via a tube tightly fitted in the soil.

A physical analysis and laboratory tests were made to determine the time required for the collected gas to be representative of the soil atmosphere at any depth. For all conditions, this time depends on initial differences between the partial pressure of a gas in the collection chamber and in the soil. When the percentage of water-free pores in soil is approximately 20 or greater, the time is strongly dependent on the volume of the collection chamber and on the diameter and length of the tube connecting the chamber to a point in the soil. For porosities between 0-15 percent, the effect of reduced diffusion rates in soil becomes significant and increases the time. Equations are given for making these calculations.

RECORDING SOIL MOISTURE AUTOMATICALLY

By B. L. Korty and H. Kohnke. Soil Sci. Soc. Amer. Proc. 17: 307-10. 1953.

A method utilizing nylon blocks and an automatic recording potentiometer equipped to record resistance by means of a special ohm-meter circuit was used to follow the moisture content of the soil continuously. The information obtained was used in correlation with rainfall data to estimate the time required for water to reach various depths in the soil.

The results show that water moved downward more rapidly on a watershed where conservation practices were used than on a prevailing-farm-practice watershed. An automatic instrument of the type used in this work that follows soil-moisture conditions would be of great value in many research problems.

ON THE THERMAL CONDUCTIVITY OF SOIL, WITH SPECIAL REFERENCE TO THAT OF FROZEN SOIL

By Akira Higashi. Amer. Geophys. Union Trans. 34: 737-748. 1953.

Using the angstrom principle, a new apparatus for measuring the thermal diffusivity of soil was designed. To give the sinusoidal boundary condition, the apparatus was constructed to change the applied voltage of a heater. A simple autotransformer and a special cam were used for this purpose. Using this apparatus, the thermal diffusivity of frozen soil as well as wet soil was measured. For frozen soil, the samples were prepared under the conditions similar to natural frost formation. Thermal conductivity was computed from the diffusivity thus obtained and the volume specific heat of the soil. Moisture relation of the thermal diffusivity and the thermal conductivity of frozen soils are represented by an empirical formula of exponential form.

The formula holds only in the range of moisture content below the saturation. These relations are shown graphically. Similar measurements were carried out with wet soil at room temperature. In nature, we often observe the segregation of ice in frozen soil. Such a frozen soil usually contains more water than that of saturation. Samples of various modes of segregation of ice were artificially prepared, and their thermal diffusivity was measured. For the moisture ratio above saturation, the rate of increase of the thermal diffusivity with respect to moisture ratio is smaller than that expressed by the above formula. The variation of the thermal diffusivity of the frozen soil in relation to the direction of heat flow is comparatively small.

MODULUS OF RUPTURE AS AN INDEX OF CRUSTING OF SOIL

By L. A. Richards. Soil Sci. Soc. Amer. Proc. 17: 321-23. 1953.

Apparatus and procedure are described for measuring the modulus of rupture of soil. Briquets approximately 1 x 3.5 x 7 cm. are formed by placing

screened dry soil in brass molds, wetting for 1 hour by subbing and drying at 50° C. The force required to break a briquet when loaded as a horizontal beam is measured, and the modulus of rupture, which is the maximum fiber stress, is calculated by the formula $s = 3FL/2bd^2$.

At Riverside, Calif., a fine sandy loam under field conditions showed no diminution of stand of bean seedlings for means with s equal to 103 ± 3 millibars, even though surface crusting effects were markedly in evidence. However, with the exchangeable-sodium-percentage artificially increased to 37, s increased to 273 ± 6 millibars and no bean seedlings emerged. This failure to obtain a stand was presumably due to the increased mechanical strength of the surface crust caused by the presence of exchangeable sodium.

PRESSURE DISTRIBUTION IN SOIL COLUMNS DRAINING INTO THE ATMOSPHERE

By J. N. Luthin and R. D. Miller. Soil Sci. Soc. Amer. Proc. 17: 329-333. 1953.

Columns of soil 122 cms. long were first wetted with water and then allowed to drain into the atmosphere. During drainage measurements were made of the pressure distribution in the soil columns and of the rate at which water drained out of the columns and into the atmosphere. At the experiment's end, the soil columns were sectioned and the moisture distribution measured. The experimental results emphasize the importance in drainage of the tension required to produce entry of air into the soil surface. The difficulty in the drainage of tight clay soils may be due more to the high tension required to produce entry of air into the soil than to the low hydraulic conductivity of the soil.

Indirect evidence indicates that in the field, movement of water in the capillary fringe above the water table may be of considerable importance. This is especially true for falling water table. The use of Laplace's equation in the study of flow in the capillary fringe is discussed briefly.

EQUIPMENT FOR SUBSAMPLING AND PACKING FRAGMENTED SOIL SAMPLES FOR AIR AND WATER PERMEABILITY TESTS

By R. C. Reeve and R. H. Brooks. Soil Sci. Soc. Amer. Proc. 17: 333-336. 1953.

The permeability ratio, air to water, is used as a measure of the stability of soil structure. Equipment and procedures are described for subsampling, placement in containers, and packing fragmented soil samples for air and water-permeability tests. Dropping the soil sample through a 4.75 mm. diameter round-hole screen into the soil container gave a more uniform pack than four other packing methods tested.

A reproducible degree of packing, as determined by air permeability determinations, was obtained by dropping the soil-filled container repeatedly from a height of 2.5 cm. Intrinsic (air) permeability decreased rapidly with degree of soil packing and reached an approximately constant

value at about 200 impacts. The relation between air permeability and bulk density was approximately linear for two soils tested.

THE SOIL PENETROMETER IN SOIL COMPACTION STUDIES

By C. W. Terry and H. M. Wilson. Agr. Engin. 34: 831. 1953.

The Cornell soil penetrometer is effective in demonstrating the cause and effect of soil compaction and is useful in research and exploratory studies. Its principal advantage over hammer-type penetrometers is that it is self-recording and no calculations are needed to interpret results. It is an excellent teaching device. The results obtained in field studies seem to be reliable. An elementary knowledge of soil physics and a little common sense are all that are required to use it.

ION EXCHANGE EQUILIBRIA IN THE PRESENCE OF SMALL AMOUNTS OF ELECTROLYTE

By M. E. Harward and N. T. Coleman. Soil Sci. Soc. Amer. Proc. 17: 339-342. 1953.

Studies were conducted to obtain quantitative information on cation distribution in clay-water systems in the presence of small amounts of electrolyte and to test the ability of mass-action-type exchange equations to predict the distributions of metal cations in these systems. Small amounts of HCl (0.004 to 0.10 symmetry) were added to variously base saturated bentonite and halloysite suspensions. The distributions of cations were determined from an analysis of the supernatant liquid after equilibrium was obtained.

When HCl was added to Ca-K-clays, the exchange constant, K_{K-Ca} , as calculated by the "statistical" exchange equation, was not invariant. The value of K_{K-Ca} increased with increasing K-saturation and decreased with increasing Ca-saturation. Variations in K_{K-Ca} were somewhat smaller when the exchange acidity was assumed to be associated with exchangeable Al.

Nevertheless the "statistical equation" may be used to estimate fairly satisfactorily the amounts of K^+ and Ca^{++} in solution when HCl is added to these clay systems.

MORE DURABLE PLASTER OF PARIS MOISTURE BLOCKS

By G. J. Bouyoucos. Soil Sci. 76: 447-451. 1953.

A new plaster of paris block which is more durable and sensitive and gives better performance than the old type is described. New type electrodes make this possible. The new electrodes are short and thick and, in contrast to the old type, assure remarkable uniformity in the readings of the blocks.

IMPROVED MODELS OF THERMAL DIFFUSION IN THE SOIL

By H. Lettau. Amer. Geophys. Union. Trans. 35: 121-132. 1954.

The nonhomogeneous case of soil-heat conduction, that is, when soil-heat conductivity and capacity are functions of depth, can be treated rigorously. An exact formula is derived which gives the thermal diffusivity of the soil as a function of depth, on the basis of Fourier coefficients of diurnal courses of soil temperature at a variety of depths.

By employment of the new model of soil-heat diffusion one avoids misleading results which are obtained when the classical model of heat diffusion in a solid conductor is applied to natural soil indiscriminately.

Soil Chemistry

FACTORS AFFECTING DISTRIBUTIONS OF CATIONS IN CLAY-ELECTROLYTE SYSTEMS

By M. E. Harward and A. Mehlich. Soil Sci. Soc. Amer. Proc. 17: 227-230. 1953.

Investigations were conducted on some factors which influence distributions of K and Ca in clay-electrolyte systems. The method involved the additions of acids to variously base saturated suspensions of Utah bentonite and Kamec halloysite. The distributions of K and Ca were determined from an analysis of the supernatant liquid after equilibrium was obtained.

The results suggest that the effect of Ca-saturation upon the replacement of K is related to type of colloid and to the amount of acid added. When HCl in amounts greater than 0.09 symmetry were added to Utah bentonite systems, the amount of K in solution increased with Ca-saturation, reached a maximum, and then decreased. The degree of Ca-saturation at which the maximum amount of K was in solution was dependent upon the amount of acid added to these systems.

FACTORS AFFECTING ADSORPTION OF CATIONS BY PLANT ROOTS

By A. Mehlich. Soil Sci. Soc. Amer. Proc. 17: 231-234. 1953.

The adsorption of Ca, Mg, K, and Na by metabolically inactive H-roots of wheat and alfalfa in relation to the nature of the anion were studied. Titration curves and fH values showed wheat roots to have a weaker acid character than alfalfa roots.

A high retention of H^+ over metal cations was indicated. As a consequence, only small amounts of cations were adsorbed when offered as nitrates, but large amounts were adsorbed when offered as

the bicarbonates. The order of increasing adsorption in either case was: Na, K, Mg, Ca.

When Ca, Mg, and K were offered in exchangeable form on a soil colloid with Ca/Mg and Ca/K ratios of 4, the Ca/Mg ratios on the roots were 4 and 8, and the Ca/K ratios were 10 and 24 for the wheat and alfalfa roots, respectively. The corresponding distribution of cations on the wheat roots were: Ca, 73 percent; Mg, 19 percent; K, 8 percent; and for alfalfa roots they were: Ca, 85 percent; Mg, 11 percent; and K, 4 percent.

USE OF Ca45 LABELED QUENCHED CALCIUM SILICATE SLAG IN DETERMINATION OF PROPORTIONS OF NATIVE AND ADDITIVE CALCIUM IN LYSIMETER LEACHINGS AND IN PLANT UPTAKE

By D. E. Davis, W. H. MacIntire, C. L. Comar, W. M. Shaw, S. H. Winterberg, and H. C. Harris. *Soil Sci.* 76: 153-163. 1953.

A Ca45 tagged Wilson Dam slag was incorporated at five rates in Hartsells fine sandy loam and Claiborne silt loam, in simultaneously conducted lysimeter and plant culture studies in which leachings and crops were analyzed for total calcium and for Ca45.

The leaching action of 49.21 inches of rainfall removed approximately 9 to 12 percent of the slag-derived calcium from the several inputs in Hartsells soil and 5 to 7 percent from the corresponding inputs in the Claiborne soil. Under the imposed conditions, the Ca of the slag exchanged with the calcium of the soil less rapidly in the Hartsells than in the Claiborne soil, and, apparently, isotopic equilibrium had not been reached in the Hartsells soil at the end of the experiment.

POTASSIUM COMPETITION IN GRASS-LEGUME ASSOCIATIONS AS A FUNCTION OF ROOT CATION EXCHANGE CAPACITY

By B. Gray, M. Drake and W. G. Colby, *Soil Sci. Soc. Amer. Proc.* 17: 235-239. 1953.

Ladino clover, smooth bromegrass, Kentucky bluegrass, and bentgrass were grown in greenhouse pots to determine the relative uptake of K by the species when grown separately and to study the competition for K when Ladino clover was grown in association with each of the three grasses. This was to determine to what extent the theory of differential cation uptake by plants of different root cation exchange capacity can explain the disappearance of legumes from pasture mixtures as a result of plant competition for K. Potassium uptake by plant species at low levels of soil K was closely correlated with root cation exchange capacity.

The relative K compatibility was smooth brome (best), Kentucky blue (intermediate), and bentgrass (poorest). Because of the strong attraction and high uptake of K by roots of bentgrass, it was impossible with practical rates of K fertilization to maintain an adequate K supply for the associated Ladino clover.

ELECTROCHEMICAL PROPERTIES OF HYDROGEN CLAYS FROM SEVERAL INDIAN SOILS IN RELATION TO THEIR MINERALOGICAL MAKEUP

By B. B. Roy and S. C. Das. *Soil Sci.* 76: 97-105. 1953.

This paper deals with the characterization of the minerals present in clays isolated from several typical soil profiles of different localities of India, through an examination of their electro-metric titration curves with Ba(OH)₂ and their viscosity curves, supported by chemical analysis of the H clays, thus correlating the nature of the clay minerals with these soil types. In India, soil surveys have so far been based on fertility status and the physical properties of the soils, and such correlation will, therefore, show the importance of mineralogical analysis of the clay fraction for permanent soil classification.

ANISOTROPY AND MEASUREMENT OF AIR PERMEABILITY OF SOIL CLODS

By M. F. DeBoodt and D. Kirkham. *Soil Sci.* 76: 127-133. 1953.

A method for measuring the air permeability of a clod of soil is described. The method is applied to clods collected from the natural fabric of the soil. The measurements show that some soils are anisotropic to flow of air. In the A horizon of Clarion loam and Ida silt loam the horizontal air permeability was twice vertical. In the B horizon of the Ida silt loam no anisotropy was detected. The possibility of using clods for other physical measurements is discussed.

X-RAY CHARACTERISTICS OF CLAY MINERALS AS RELATED TO POTASSIUM FIXATION

By G. W. Kunze and C. D. Jeffries. *Soil Sci. Soc. Amer. Proc.* 17: 242-244. 1953.

Evidence is presented to support on structural grounds the early potassium fixation theories based on entrapment of the potassium ion due to the closure of the interlayer spaces. Field surface samples (0-6 inches) of 15 soils classified as Gray-Brown Podzolics from which the clay was extracted served as experimental material. The soil-clays were saturated with potassium and a divalent cation and the effect on the basal spacings noted.

X-ray diffraction results suggested that those soil-clays which showed a strong 10 angstrom line when potassium saturated, as contrasted to a strong 14 angstrom line when saturated with a divalent cation, were relatively high fixers of potassium. Those soil-clays which showed little or no shifting of the larger basal spacings toward 10 angstroms when saturated with potassium were found to be relatively low fixers of potassium.

MICA WEATHERING SEQUENCE IN THE HIGHFIELD AND CHESTER SOIL PROFILES

By C. D. Jeffries, B. N. Rolfe, and G. W. Kunze.
Soil Sci. Soc. Amer. Proc. 17: 337-339. 1953.

A procedure for determining the nature of the micas in soils and the application of this procedure to the study of the weathering characteristics of the micas in the Highfield soil profile from Pennsylvania and the Chester soil profile from Virginia is described.

The results indicate a definite type of weathering sequence of the micas, which consists of mica--micá intermediate, to hydrated mica to chlorite--kaolin.

CHEMICAL FACTORS IN CATION EXCHANGE BETWEEN ROOT SURFACES AND NUTRIENT MEDIA

By C. E. Marshall and W. J. Upchurch. Soil Sci. Soc. Amer. Proc. 17: 222-227. 1953.

Experiments were designed to throw light on two main factors in cation uptake; the cationic activity of the nutrient medium and the mean free energy change of the reaction in which nutrient ions are exchanged for hydrogen ions. The third factor--the activity of the hydrogen ions--was not fully investigated, but has been reported on by other workers. The theoretical basis for the determination of free energy changes is first examined. For roots growing in colloidal substrates, three possible procedures follows: (1) By adding algebraically the individual free bonding energies of the two cations to the two colloidal surfaces, the free energy change for the reaction can be calculated. This involves individual activity determinations by potentiometric methods. (2) By small exchanges, ratios of activities can be obtained which can be used directly in the equations. (3) By applying Donnan conditions to the equations, simplified equations involving ratios of concentrations are obtained. From these, the free energy changes can be calculated from determinations of total cationic composition of the two exchangers.

The composition of soybeans (roots and tops) grown in different true solutions--chlorides and bicarbonates of K and Ca, and in K and Ca Amberlite, K and Ca Putnam clay, and K and Ca bentonite--was examined. Corresponding to the 2,500-3000 calorie advantage of bicarbonates over chlorides, greater uptake of K and Ca from the former was observed. Where the three dominant factors were the same for two media (acidic KCl and acidic K-Amberlite) growth and uptake were closely similar. Differences of 1,500-2,000 calories in the free energy change for different substrates markedly affected uptake.

DETERMINATION OF FIXED SOIL POTASSIUM

By D. W. Kolterman and E. Truog. Soil Sci. Soc. Amer. Proc. 17: 347-351. 1953.

After making preliminary tests of methods proposed by other investigators for determining the fixed potassium of soils and also of several new approaches, the approach found most promising--heating at 500° C. for 2 hours--was investigated in detail. By heating ammonium saturated soils, illite, and bentonite in this manner, substantial release of nonexchangeable or fixed potassium could be effected without breakdown of primary potassium minerals. Not all of the fixed potassium can be released in one heating, the amount thus released representing an equilibrium point related to the amount which still remains fixed.

The procedure finally adopted consists in heating ammonium saturated soil at 500° C. for 2 hours, then extracting the potassium made exchangeable with ammonium acetate solution, and finally determining the potassium in the solution by means of the flame photometer. This heating, extracting, and determining are repeated once, and from the amount of fixed potassium released during the second heating, the total amount of fixed potassium present may be calculated by use of a summation formula for a geometric progression. The method is simple and is adaptable to rapid analysis of large numbers of samples. From the results obtained, it is believed that the method is reasonably specific for fixed potassium, and offers the possibility of being a practical and reliable method.

IRON OXIDE REMOVAL FROM SOILS AND CLAYS

By N. H. Aguilera and M. L. Jackson. Soil Sci. Soc. Amer. Proc. 17: 359-364. 1953.

Iron oxide coatings or crystals must be removed from soils in which they are found in many mineralogical techniques for identification of colloidal layer silicates as well as the identification of silt and sand grains with the polarizing microscope. A procedure is presented which employs sodium dithionite ($\text{Na}_2\text{S}_2\text{O}_4$, hyposulfite, or "hydro-sulfite) as the reductor, and 0.3 molar citrate with or without Fe-3 specific Versene as the chelating reagent. It is a neutral system, the pH of which is kept at 7.3. The reaction is fast, as much as 20 percent of iron oxides (hematite, goethite, or limonite but not magnetite or ilmenite) being removed from a soil in 15 minutes, and does not precipitate either elemental sulfur or iron sulfides. Like other procedures, it causes some decrease of exchange capacity of layer silicates which contain iron, and at the same time may increase the exchange capacity of kaolinitic soils.

MECHANISMS RESPONSIBLE FOR RETENTION OF MANGANESE
IN THE COLLOIDAL FRACTION OF THE SOIL

By G. A. Hemstock and P. F. Low. Soil Sci. 76:
331-343. 1953.

Factors influencing manganese retention by soils were studied. The hypothesis that manganese can be retained by soil organic matter in the form of a chelate complex is presented.

INFLUENCE OF SOIL ZONE ON THE CHEMICAL COMPOSITION OF CEREALS IN ALBERTA

By J. D. Newton. Canad. Jour. Agr. Sci. 33: 359-378. 1953.

The average protein content of grain grown was not directly related to the nitrogen content of the soil, as between the brown and black soil zones, but was directly related as between the black and gray soils. This has an important bearing on feeding value of grain and malting quality of barley grown in different zones. No direct relation was found between total phosphorus content of soil and crop. The black soils are generally highest in total phosphorus and the gray lowest.

The total sulphur content of grains grown on sulphur-deficient gray wooded soils was relatively low, but no consistent difference was found between the grains grown in brown and black soils. There was no consistent relation between total calcium or magnesium contents of soils and grain. The magnesium content of the grain was much higher than the calcium, and the oats were considerably higher in calcium than wheat or barley. The potassium content of the wheat, barley, and oats was variable and relatively low in all zones by comparison with general averages.

THE NATURE OF PHOSPHATE SORPTION BY CALCIUM CARBONATE

By C. V. Cole, S. R. Olsen, and C. O. Scott. Soil Sci. Soc. Amer. Proc. 17: 352-356. 1953.

Studies on the nature of phosphate sorption by calcium carbonate indicate that when soluble phosphate fertilizers are added to calcareous soils, the reactions with calcium carbonate consist of rapid monolayer sorption on CaCO_3 surfaces and, at high phosphate concentrations in the vicinity of fertilizer particles, the precipitation of di calcium phosphate or a compound with similar properties.

The initial products of these reactions are characterized by very high specific surfaces and greater phosphorus solubility than the stable hydroxyapatite or fluorapatite. Dynamic equilibrium in calcareous soils involves all of these forms of phosphate. Some of the effects of the ionic environment on solubility of calcium phosphates were calculated and experimentally verified.

CALCIUM-POTASSIUM INTERACTIONS IN SOILS AND PLANTS: I. LIME-INDUCED POTASSIUM FIXATION IN MARDIN SILT LOAM

By E. T. York, Jr., R. Bradfield, and M. Peech. Soil Sci. 76: 379-387. 1953.

Here was determined whether the observed calcium-potassium interaction in the plant is due to a physiological antagonism between the ions or to calcium-potassium interaction induced in the soil. Interactions of calcium and potassium in soils, with particular emphasis on the problem of lime-induced potassium fixation were emphasized.

Relatively large amounts of potassium were fixed in nonexchangeable forms upon addition of CaCO_3 to acid Mardin silt loam. This fixation occurred in moist soil and was independent of potassium fixation that took place when the soil was dried.

Soil Biology

COMPARISON OF OXGALL, CRYSTAL VIOLET, STREPTOMYCIN, AND PENICILLIN AS BACTERIAL GROWTH INHIBITORS IN PLATINGS OF SOIL FUNGI

By A. Bakker-spigel and J. J. Miller. Soil Sci. 76: 123-126. 1953.

Oxgall in concentrations of 1:100 and 1:40 compared favorably with crystal violet dye, dihydrostreptomycin sulfate, and penicillin G in suppressing development of bacteria in soil platings.

Crystal violet dye was less effective in suppressing bacteria than were the other antibacterial substances at the concentrations employed. Bacteria in rhizosphere soil seemed to be affected by these antibacterial substances to about the same degree as were those in control soil.

THE INFLUENCE OF SODIUM, POTASSIUM, AND AMMONIUM IONS ON THE RESPIRATION OF AZOTOBACTER CHROOCOCCUM AS RELATED TO THE COMPOSITION OF THE GROWTH MEDIUM

By C. M. Burns and J. O. Harris. Soil Sci. Soc. Amer. Proc. 17: 245-246. 1953.

Azotobacter chroococcum was able to grow in modified culture media deficient in potassium and sodium ions. Respiratory activity of the resulting cells in the presence of added potassium or sodium ions was influenced by the composition of the growth medium. Ammonium ions gave increased oxygen uptake regardless of the growth medium.

When the cells were grown in ammonium-Ashby's medium, potassium stimulated while sodium retarded oxygen uptake. Cells harvested from the sodium medium exhibited decreased respiratory activity in the presence of potassium ions. Potassium stimulation of respiration of cells grown in the ammonium rich medium appeared to be of a general

nature rather than specific for a single enzymatic process. The presence of potassium ions increased the rate at which the cells could adapt themselves to heterologous respiratory substrates.

MICROFLORA OF THE RHIZOSPHERE OF THE PINEAPPLE PLANT

By D. E. Contois. *Soil Sci.* 76: 259-272. 1953.

This study was aimed at the development of a better method for the quantitative study of microbial populations in their natural environment. It was undertaken also to ascertain the normal microflora of the rhizosphere of the pineapple plant and the more general environmental factors that affect it.

A method is presented for the quantitative-qualitative characterization of the microbial populations of a rhizosphere through the calculation of ratios of arbitrarily defined nutritional groups to one another. The relative abundance of the various nutritional groups of bacteria to one another changes with season, as does the rhizosphere effect. There appeared to be no difference in the bacterial flora of the rhizospheres of plants grown in Wahiawa and Helemano, although a suggestive difference in the fungus flora was noted. The most commonly found filamentous fungi included *Aspergilli* and *Penicillia* as well as *Trichoderma glaucum* and *T. lignorum*.

USING SOIL SURVEY INFORMATION IN LAND VALUATION FOR TAX ASSESSMENT

By A. R. Aandahl. *Soil Sci. Soc. Amer. Proc.* 17: 293-294. 1953.

Soil surveys are a tool for improving the assessment of rural lands. Soil classification provides the means for utilizing factual information in making the necessary physical predictions of soil productivity. With these predictions economic ratings for different uses of each soil can be made.

The soil map showing the location and extent of each soil permits the application of these economic ratings to specific tracts of land resulting in the first approximation of the assessed value. These must be adjusted for roads, schools, and other factors affecting the value.

Soil Genesis, Formation, Classification and Mapping

THE INFLUENCE OF WIND-BLOWN MATERIAL ON THE SOILS OF MASSACHUSETTS

By W. G. Colby, M. A. Light, and T. A. Bertinison. *Soil Sci. Soc. Amer. Proc.* 17: 395-399. 1953.

Most of the soil profiles of Massachusetts exhibit a surficial mantle of material that is genetically different from the underlying geologic formation. This surficial deposit exhibits a high content of very fine sand and silt and a very low content of the coarse fractions and clay. The deposit is relatively uniform in texture and mineralogical composition throughout the entire depth,

irrespective of the underlying geologic formation.

Results of field observations and mineralogical and mechanical analysis give convincing evidence that the surficial mantle is of wind-blown origin. Although this surficial mantle is not universal in its occurrence, most of the agricultural soils of the State are either entirely of wind-blown origin or strongly influenced by such material.

THE ACCURACY OF SOIL MAPS PREPARED BY VARIOUS METHODS THAT USE AERIAL PHOTOGRAPH INTERPRETATION

By J. A. Pomerening and M. G. Cline. *Photogrammetric Engin.* 809-817. 1953.

The study reported here involved two principal objectives: (1) measurement of the accuracy of soil mapping for agricultural uses by methods that depend to varying degrees on the interpretation of aerial photographs, and (2) measurements of the effect of complexity of the landscape on the accuracy of these methods. An attempt was also made to obtain some indication of variation of accuracy among individuals recognized as competent in their field. Methods that rely upon aerial photo interpretation alone for final identification of mapping units produce less detailed and less accurate soil maps of young landscapes than do those which rely upon field identification and delineation but use aerial photo interpretation to guide the placement of boundaries.

Increasing complexity of the landscape greatly reduces the accuracy of aerial photo interpretation but affects field survey methods using aerial photographs to only minor degrees. Increasing importance of soil properties not associated with prominent landforms also greatly reduces the accuracy of aerial photo interpretation. Field survey methods using aerial photographs are much less dependent upon such association with landform.

A STUDY OF SOME CHARACTERISTICS OF KEENE SILT LOAM AND MUSKINGUM SILT LOAM

By F. R. Dreibelbis and W. H. Bender. *Jour. Soil and Water Conserv.* 8: 261-266. 1953.

A contrast of the soil-water relation in Ohio has shown that the relative amounts of gravitational, capillary, and hygroscopic water vary with soil type. In the Muskingum, the water drains more readily from saturation to field capacity than in the heavier Keene soil. The latter retains more moisture in the capillary and hygroscopic forms. The available storage capacity for water in a 24-inch soil depth amounts to 8.32 and 8.24 inches for the Keene and Muskingum soils, respectively, at the driest point found under field conditions.

As the soil moisture approaches saturation, this storage space is correspondingly reduced. The surface runoff is much higher on the Keene

soil during the winter and spring months than on the Muskingum. Percolation of water through the profile is greater on the Muskingum soil. Records over 8 years show that the average evapotranspiration is 1.6 inches higher on the Keene silt loam during the growing season--April to September.

INFLUENCE OF CERTAIN SOIL-PROFILE CHARACTERISTICS UPON THE DISTRIBUTION OF ROOTS OF GRASSES

By R. L. Fox, J. E. Weaver, and R. C. Lipps, *Agron. Jour.* 45: 583-589. 1953.

A study was made of some physical and chemical properties of five soils. These properties were related to the distribution of grass roots. Limited root development in the surface horizon of a Butler soil was associated with low nitrogen content.

Root branching was restricted in the claypans of a Butler and a Crete soil. Restricted root development in this horizon was related to severe limitations in available phosphorus. Root development was not limited in the B horizon of a second Crete soil characterized by a relatively high level of soluble phosphorus throughout the profile. Deep rooting of Kentucky bluegrass occurred in a Judson soil which presented a favorable supply of plant nutrients at all depths in the profile. A Carrington soil, deficient in available phosphorus in the subsoil, produced bluegrass with a shallow root system. Exchangeable potassium and soil nitrogen may also have been limiting factors for root development in this soil.

BROWN FOREST, POLYGENETIC, AND CONGELITURBATE PROFILES OF POTTER COUNTY, PENNSYLVANIA

By K. V. Goodman. *Soil Sci. Soc. Amer. Proc.* 17: 399-402. 1953.

A Brown Forest soil, soils having polygenetic profiles, and soils believed to have developed in materials formed by frost action and slope creep were mapped in Potter County, Pa., an area of normally well-developed Podzol soils. Because of the complex conditions which existed at the margins of the continental glaciers, soil classification is difficult in these areas. Field observations and the following laboratory analyses were made: mechanical analyses, pH determinations, X-ray diffraction analyses, and exchangeable cation and base saturation determinations.

The results show that the outstanding characteristics of the Brown Forest great soil group can be identified in units as small as a single soil type. The Brown Forest profile has a characteristic granular structure, brown color, and a variation in pH from nearly neutral to acid to alkaline from the surface downward. The presence of gibbsite, usually associated with tropical weathering, in the lower part of the Sweden (tentative) series suggests that it is of polygenetic nature and that the lower part of the profile formed prior to Wisconsin glaciation. The physical and chemical analyses of the congeli-

turbate profiles, as well as lack of erratics and rounded sands and gravels, suggest that although till-like in nature, such profiles may have developed in materials formed as a result of frost action rather than glacial action. Further study is needed to substantiate this hypothesis.

HYDROLOGY

General

ON FACTORS GOVERNING SUBSURFACE STORM FLOW IN VOLCANIC ASH SOILS, NEW ZEALAND

By B. D. van't Woudt. *Amer. Geophys. Union Trans.* 35: 136-144. 1954.

The possible occurrence of subsurface storm flow in volcanic ash soils was investigated by means of small lysimeters with and without window openings to measure lateral flow. The information obtained from the lysimeters led to a further investigation of apparently aberrant results by a number of experimental methods largely devised under field conditions.

The results obtained from these experiments show that a lateral flow through the surface soil on sloping ground during rainstorms may be caused by (1) a resistance to wetting exhibited by the surface soil at a low moisture content, (2) a low permeability of the B horizon compared with that of the A horizon, apparently related to an initial anisotropy in the ash beds, and (3) the transition from a fine-to a coarse-textured layer. The magnitude of this flow depends largely on the intensity of a rainstorm.

STREAM-FLOW FREQUENCY DISTRIBUTIONS IN CALIFORNIA

By D. K. Todd. *Amer. Geophys. Union Trans.* 34: 897-905. 1953.

The flow-duration curve as a means of expressing streamflow distribution is briefly described together with its applications and construction. Flow-duration curves were prepared for a selected group of 10 California streams.

The shapes of these curves are discussed in relation to the prevailing basin and climatic conditions. To clarify the analysis further, frequency curves in the form of histograms were plotted. The usefulness of the frequency curve over the flow-duration curve for analytical purposes and the need for further study are emphasized.

FLOAT-VALVE PRESSURE CONTROL FOR POROUS-PLATE APPARATUS

By R. J. Hanks, E. E. Miller, and C. B. Tanner. *Soil Sci. Soc. Amer. Proc.* 17: 318-320. 1953.

A new type of pressure-control regulator is described. The performance of this regulator is compared with the mercury tower regulator and with a two-stage diaphragm regulator. The mercury tower and float-valve regulators were both sufficiently precise for use with porous-plate apparatus. The mercury tower was found to be quite inconvenient to use, requiring more experience than either of the other regulators.

The float-valve regulator was found to be easy to use with very little experience but was neither simple nor economical to construct. It was found that the two-stage diaphragm regulator was not a precise pressure control below the 0.4 atm. However, because it is compact and inexpensive, the two-stage diaphragm regulator appears to be quite useful where precision is not required.

VELOCITY DISTRIBUTION AND THE BOUNDARY LAYER AT CHANNEL BENDS

By H. A. Einstein and J. A. Harder. Amer. Geophys. Union Trans. 35: 114-120. 1954.

An analysis of the accelerating forces available within a relatively wide, shallow channel bend shows that the existence of higher velocities near the outside bank requires, in addition to the helical flow pattern commonly observed, that the outward flowing upper layers be unaffected by bed shear. Velocity measurements made in a model channel bend at a point unaffected by entry conditions have confirmed this requirement, indicating that the inward flowing bottom layers move within a boundary layer similar to those found near the surface of airfoils.

The parameter $(r/v) dv/dr$, which should have the value -1 for free vortex flow and +1 for flow with constant angular velocity, exceeded +4 in these experiments and was found to be directly proportional to the friction factor. Theory developed indicates that this parameter is directly proportional to the width-radius ratio also in those regions beyond the effect of entry conditions.

CAN THE RATE OF WASH LOAD BE PREDICTED FROM THE BED-LOAD FUNCTION?

By H. A. Einstein and Ning Chien. Amer. Geophys. Union Trans. 34: 876-882. 1953.

There exist two types of sediment load, one that bears a certain relation with the discharge (bed-material load), and the other which does not (wash load). The result of flume study indicates that the transport rate of wash load, just as that of the bed-material load, can be calculated according to the Einstein bed-load function if the instantaneous bed composition is known. On the other hand, the bed material load is equally available in the entire bed, but only the surface bed layer contains any significant amount of wash-load material.

Any change of flow or of sediment supply may immediately change the composition of the wash-load material in the bed. The bed composition as determined from the instantaneous condition of the channel has no lasting significance so far as the wash load is concerned, and this makes the

prediction of the wash-load rate from the bed-load function impossible.

Climatology

SOME PRECIPITATION-ALTITUDE STUDIES OF THE TENNESSEE VALLEY AUTHORITY

By J. Smallshaw. Amer. Geophys. Union Trans. 34: 583-588. 1953.

Three precipitation-altitude studies made cooperatively by the Tennessee Valley Authority and the U. S. Weather Bureau are discussed. In one study covering observations of a line of precipitation stations across the Great Smoky Mountains, a typical increase of rainfall with altitude is described. Results of another study, an investigation across sharp-crested Snake Mountain in North Carolina, show precipitation at the top of the ridge to be only 70 percent of that on the slopes a short distance below the crest.

A similar situation is described on Clinch Mountain in Virginia. Seasonal effects are noted, with the most pronounced differences occurring in the October-March period. The low catch at the ridge-top stations is attributed to a combination of updraft and carryover of moisture-laden air because of the steep slopes and narrow crest widths of the ridges.

Land Use Influences

EVAPOTRANSPIRATION AND OTHER WATER LOSSES ON SOME ASPEN FOREST TYPES IN RELATION TO WATER AVAILABLE FOR STREAM FLOW

By A. R. Croft and L. V. Monniger. Amer. Geophys. Union Trans. 34: 563-574. 1953.

The effects of altering an aspen forest cover in Utah on evapotranspiration losses, overland flow, erosion, and mantle storage deficits during three successive growing seasons are reported. These data, together with supplemental measures of winter precipitation and estimates of evaporation from snow, provided a basis for estimating amounts of water available for streamflow.

Removal of aspen trees, leaving the herbaceous understory and litter undisturbed reduced evapotranspiration losses and increased the amount of water available for stream flow by about 4 inches without seriously increasing overland flow or soil erosion during summer rains. Removal of the remaining herbaceous cover further reduced evapotranspiration losses and increased the amount of water available to streams by an additional 4 inches but resulted in an undesirable increase in summer rainfall runoff and soil loss.

WHITE HOLLOW WATERSHED MANAGEMENT: 15 YEARS OF PROGRESS IN CHARACTER OF FOREST, RUNOFF, AND STREAMFLOW.

By J. S. Rothacher. *Jour. Forestry*. 51: 731-738. 1953.

Fifteen years of protection and reforestation so improved the forest cover of 1,715-acre White Hollow watershed in eastern Tennessee that the summer peak flows were reduced 73 to 92 percent; duration of summer-storm runoff was prolonged up to 500 percent. A more sustained flow resulted without any material change in total water yield.

The original forest cover increased in volume from 4,444,000 to 7,104,000 board-feet. Natural and planted stands so controlled erosion on open lands that White Creek now maintains a flow of clear water suitable for rearing trout.

RAINFALL AND RUNOFF CHARACTERISTICS ON A SMALL WATERSHED IN THE SOUTHERN PIEDMONT

By J. R. Carreker and A. P. Barnett. U. S. Dept. Agr. SCS-TP-114. 1953.

Rainfall and runoff measurements were made during 12 years, 1940-51, on a bench-terraced field of 19.2 acres comprising a unit watershed. The Cecil soil, degree of slope, topography, and cropping were representative of many sloping cropland fields throughout approximately 22 million acres of land in the Southern Piedmont area of the United States.

The area was cropped under a 2-year rotation of oats, cowpeas, and cotton through 1943. Corn and kudzu were planted in 1944. The kudzu developed into a thick stand in 1946 and remained on the field throughout the rest of the period of record.

The cropping practices had a marked effect on the runoff characteristics of this field. Thunderstorm rains of high intensity and short duration resulted in high rates of flow under the 2-year rotation of oats, cowpeas, and cotton. Rains of long duration, large volume, and low intensity also caused large volumes of runoff with this cropping practice. The rate of flow responded quickly to changes in the rainfall intensity.

The highest runoff rate (2.31 inches per hour) occurred when rains of high intensity fell on saturated ground with a poor cover of dormant thin-stand kudzu. After kudzu became fully established, the thunderstorm rains usually were absorbed completely and only the rains of long duration and large volume caused appreciable runoff. Even with such rains, the rate of flow was always very low and never exceeded 0.5 inch per hour. The probable peak rates of runoff for frequencies ranging from 2 to 50 years, computed from the recorded rates, were 1.47 to 2.88 inches per hour

for the oats, cowpeas, and cotton and 0.24 to 0.75 inch per hour for the kudzu.

EVALUATION OF SIGNIFICANCE OF SLOPE CHANGES IN DOUBLE-MASS CURVES

By L. L. Weiss and W. T. Wilson. *Amer. Geophys. Union Trans.* 34: 893-896. 1953.

The double-mass method is commonly used in the interpretation of precipitation records. Interpretation of double-mass curves frequently involves rejection or acceptance of indicated changes in slope. Often, the decision must be based on inadequate station records. It is important that the analyst should know the probability of getting an abrupt slope change purely by chance.

The significance of any slope change can be evaluated by a statistical treatment making use of range instead of standard deviations. The application is simplified by a special protractor and sample nomograph.

WATERSHED MANAGEMENT EXPERIMENTS IN THE COLORADO FRONT RANGE

By L. D. Love. *Jour. Soil and Water Conserv.* 8: 213-218. 1953.

Plot studies in the Colorado Front Range show that heavy grazing by livestock doubles the amount of surface erosion and increases runoff by about two-thirds when compared with plots moderately grazed.

Infiltration studies point to a decrease of 118 percent in the water absorption rate of mixed granitic and schist soils when very poor forage condition is contrasted to good. These and other studies illustrate the extent to which native vegetation can lessen accelerate erosion and runoff.

RUNOFF FROM CONSERVATION AND NON-CONSERVATION WATERSHEDS

By R. W. Baird. *Agr. Engin.* 35: 95-97. 1954.

The conservation plan applied to area y-2 has resulted in more effective use of water by crops, and appreciable increase in crop yields has been measured. These increases are probably due to somewhat higher fertility level of the land because of the use of legumes in the crop rotation and reduction of runoff during critical periods.

All indications are that areas with conservation practices recover their water-holding capacity more quickly after rains and have a higher intake rate.

Ground Water

SEA-WATER INTRUSION INTO GROUNDWATER BASINS BORDERING THE CALIFORNIA COAST AND INLAND BAYS

By H. O. Banks and R. C. Richter. Amer. Geophys. Union Trans. 34: 575-582. 1953.

Sea water has already invaded, or poses an immediate or potential threat of invasion, in at least 80 major and minor ground-water basins in California. There is definite evidence of intrusion into 13 of these basins and immediate danger of intrusion in 7 additional basins. Sea water intrusion has occurred wherever the normal seaward hydraulic gradient has been reversed for protracted periods of time.

Possible methods of control to restrain encroachment or reduce the area already affected include: (1) raising ground-water levels to or above sea level by reduction or rearrangement of pattern of pumping draft, or both; (2) direct recharge of overdrawn aquifers to maintain ground-water levels at or above sea level; (3) maintenance of a fresh-water ridge above sea level along the coast; (4) construction of artificial subsurface dikes; and (5) development of a pumping trough adjacent to the coast. The California Legislature has appropriated \$750,000 for an experimental program to determine design criteria for the prevention and control of sea-water intrusion.

Structures

A RUNOFF SAMPLER FOR LARGE WATERSHEDS: I. LABORATORY STUDIES

By K. K. Barnes and R. K. Frevert. Agr. Engin. 35: 84-90. 1954.

Laboratory tests were conducted of the sampling characteristics of a narrow sharp-edged slot extending downstream from the notch of a drop spillway structure and depressed from the horizontal by an angle of 5 to 10 degrees. Intake of such a sampler was found to be dependent upon the angle between the sides forming the boundaries of the slot, the width of the slot, and the critical depth of flow over the notch. Intake was independent of the angle the slot made with the horizontal in the range of 5 to 20 degrees and of the viscosity and density of water in the range of 40 to 80° F.

Laboratory tests indicated the sampler was self-cleaning of trash. These findings were used to develop a slot-type sampler which would take a constant portion of the flow through a notch spillway.

SOIL AND WATER MANAGEMENT

General

SOIL SPLASH BY RAINDROP IMPACT ON BARE SOILS

By B. Osborn. Jour. Soil and Water Conserv. 9: 33-38+. 1954.

Detachability of soil varies with the permanent characteristics of the soil unit, such as size and

shape of particles, and with changing conditions within the same soil, including structure, organic-matter content, and influences of plant and animal life. Changing conditions within the same soil, because of ecological processes and the effects of land use and management, seem to cause greater variations in detachability than do the inherent characteristics of the soil. Detachability rates of medium-textured soils averaged somewhat lower than either fine-textured or coarse-textured soils.

Under field conditions, detachability rates averaged materially higher for cropland soils than for ranges or pasture lands. Tillage contributes to high detachability of cropland soil. Surface crusts formed by lichens, molds, and other low forms of plant life greatly reduce detachability of exposed soils on rangelands in depleted condition. Soil detached and set in motion by raindrops is not necessarily lost from the area, but it is available for removal by surface runoff if present. These tests indicated the large erosion hazards inherent in the splash effects of a 2-inch rain of impact equivalent to a hard thunderstorm.

FIELD MEASUREMENTS OF SOIL SPLASH TO EVALUATE GROUND COVER

By B. Osborn. Jour. Soil and Water Conserv. 8: 255-60+. 1953.

Plant cover on the land surface offers resistance to the kinetic energy of rainstorms and protects the soil from detachment and dispersal by raindrop impact. The effectiveness of the cover in preventing soil splash is proportional to the amount present at the time the rain falls.

This is the first of three articles reporting results of field measurements of splash in relation to kinds and amounts of cover. It shows that from 4,000 to 6,000 pounds of ground cover per acre, including both standing forage or crops and litter, are required to prevent the initiation of erosion by hard rainstorms, and that soil splash increases rapidly as the amount of cover declines below 2,000 to 3,000 pounds per acre.

CONTINUOUS PLANT COVER--THE KEY TO SOIL AND WATER CONSERVATION

By J. H. Stallings. U. S. Dept. Agr. SCS-TP-121. 1953.

The role of plants in preserving and building soil, and why continuous plant cover is essential to a successful soil and water conservation program, are explained. The primary function of plant cover is to protect soil from erosion by absorbing the destructive energy of wind and falling raindrops.

Losses of plant nutrients and soil organic matter by erosion can be controlled by plant cover and maintenance of continuous plant cover is the only practical means by which the soil organic-matter content can be maintained and actually

increased. Cover aids in building up and maintaining a high degree of aggregation or tilth and productivity and aids in preserving moisture by increasing infiltration and decreasing runoff and soil loss.

AFGHAN ALKALI SOIL AND ITS IMPROVEMENT

By G. F. Hauser. *Soil Sci.* 76: 367-375. 1953.

A common type of alkali soil in the Kabul wheat area was investigated by periodical soil analyses combined with an irrigation study and a field trial with wheat, barley, and oats. Crop yields showed that gypsum treatment can make the soil suitable for growth of wheat. It effected a yield increase of 105 percent for wheat, 36 percent for oats, and 7 percent for barley.

Fertilizers and Soil Fertility

NITROGEN, PHOSPHORUS, and POTASSIUM CONTENT OF THE CORN LEAF AND GRAIN AS RELATED TO NITROGEN FERTILIZATION AND YIELD

By W. F. Bennett, G. Stanford and L. Dumenil. *Soil Sci. Soc. Amer. Proc.* 17: 252-258. 1953.

Eight nitrogen sidedressing experiments were conducted to determine the effectiveness of side-dressed nitrogen on corn as shown by yield response and by the chemical composition of the corn leaf and grain. A wide range in response to nitrogen occurred. Application of nitrogen significantly increased the percent of nitrogen in the leaf on all experiments, whereas, the nitrogen content of the grain was significantly increased on only 5 of the 8 experiments.

Phosphorus percentage in the leaf was significantly increased due to nitrogen application on certain experiments; and these increases were associated with yield responses which proved to be independent of the nitrogen effect.

FERTILITY STUDIES ON SOIL TYPES: III. PHOSPHORUS SUPPLY AND REQUIREMENT AS SHOWN BY GREENHOUSE STUDIES AND LABORATORY TESTS

By A. J. MacLean, R. F. Bishop, and L. E. Lutwick. *Canad. Jour. Agr. Sci.* 33: 330-343. 1953.

Oats and alfalfa were grown in the greenhouse on samples of surface soil taken from 9 farms on each of 10 soil types. The effect of applied phosphorus as shown by yields and the phosphorus content of the crops is used as a basis for evaluating various laboratory methods for estimating the soil phosphorus available for plant growth. The relative effect of applied phosphorus on the uptake of phosphorus varied significantly according to soil type. The amounts of phosphorus extracted from surface soil samples by 5 of the chemical procedures varied significantly between soil types. Values obtained by 3 of these procedures increased with increasing clay content of

the samples, whereas, with the other two procedures, higher values were obtained for the soils of lighter texture.

The correlation coefficients relating greenhouse results with those obtained by the Neubauer procedure and by 4 of the 10 chemical procedures employed were highly significant.

FERTILITY EROSION ON TWO WISCONSIN SOILS

By H. F. Massey, M. L. Jackson and O. E. Hays. *Agron. Jour.* 45: 543-547. 1953.

Results of the determination of total solids, organic matter, total nitrogen, nitrate nitrogen, phosphorus in solution, pH 3 extractable phosphorus, and exchangeable potassium in the runoff waters from two Wisconsin soils are presented. The average annual erosion loss of soil material from Fayette silt loam, 11 percent slope, in the rotation of corn-oats-hay-hay was 7,300 pounds of soil material, 192 pounds of organic matter, 10.6 pounds of nitrogen, 0.65 pound of available phosphorus and 1.8 pounds of exchangeable potassium. Almena silt loam, 3-percent slope, lost about one third as much soil material, one half as much organic matter and nitrogen, and almost as much exchangeable potassium.

In general, greater erosion losses occurred from Almena silt loam when cropped to corn than when cropped to oats; the reverse was true on Fayette silt loam; and the controlling factor was assigned to the rainfall distribution. Other results are given.

MINERAL CONTENT OF LOW HUMIC, HUMIC, AND HYDROL HUMIC LATOSOLS OF HAWAII

By T. Tamura, M. L. Jackson and G. D. Sherman. *Soil Sci. Soc. Amer. Proc.* 17: 343-346. 1953.

Data from X-ray diffraction, elemental, differential and integral thermal, and infrared absorption analyses were used to characterize quantitatively the minerals in the clay fractions of representative soils of the Low Humic, Humic, and Hydrol Humic Latosols of Hawaii. Allophane was identified in substantial amount (approximately 30 percent) in the $< 0.2\mu$ fractions of two Hydrol Humic Latosols.

Other minerals present in the clay fractions of the Hydrol Humic Latosols include gibbsite (25-35 percent), goethite (10-35 percent), magnetite (5-20 percent), mica (1-10 percent) and quartz (0-3 percent). The Humic Latosol contained kaolinite (15-20 percent), gibbsite (15-20 percent) hematite (20-25 percent), goethite (10-20 percent), montmorillonite (5-10 percent), interstratified 2:1 layer silicate (5-10 percent), mica (1-5 percent) and quartz (1-5 percent).

The Low Humic Latosols were predominantly kaolinite (45-55 percent) with hematite (15-25 percent), allophane (5-10 percent) and montmorillonite (5-15 percent) in substantial amounts. The fractions $< 2\mu$ constitute the major portion of the

Latosols. All percentages given are of the $< 2\mu$ fractions except that two whole soils are included with the Low Humic Latosol group.

THE AVAILABILITY OF HIGH-TEMPERATURE PROCESS ALKALI (RHENANIA-TYPE) PHOSPHATES TO CROPS WHEN APPLIED TO CALCAREOUS SOILS

By W. R. Schmehl and E. J. Brenes. Soil Sci. Soc. Amer. Proc. 17: 375-378. 1953.

Four field experiments were conducted on two soil types to test the effectiveness of high-temperature alkali (Rhenania-type) phosphate fertilizers on calcareous soil. The results showed that Rhenania-type phosphate and concentrated superphosphate had about the same fertilizer value for crops grown on phosphate-deficient soils when the fertilizer was plowed under or broadcast, but there were indications that Rhenania-type phosphate was less effective than the superphosphate when the fertilizer was sidedressed.

Laboratory studies using various procedures for the determination of available soil phosphorus showed that Rhenania phosphate and concentrated superphosphate were equally effective in increasing the available phosphorus in the soil. The results indicate that the Rhenania-type phosphates offer promise as substitutes for superphosphate under many cropping conditions.

THE BEHAVIOR OF APPLIED PHOSPHORUS AND POTASSIUM IN ORGANIC SOIL AS INDICATED BY SOIL TESTS AND THE RELATIONSHIP BETWEEN SOIL TESTS, GREEN-TISSUE TESTS AND CROP YIELDS

By T. C. Bigger, J. F. Davis, and K. Lawton. Soil Sci. Soc. Amer. Proc. 17: 279-283. 1953.

Phosphorus and potassium were extracted from organic soils by rapid test methods. The extractable phosphorus was determined by a colorimetric method and the extractable potassium was determined with a flame photometer, except for the sodium nitrate extracts in which case a cobalt-nitrite procedure was employed.

A highly significant correlation exists between the amount of phosphorus and potash applied and the amount of phosphorus and potassium extracted from the soil. Applied phosphorus remained in the surface soil while potassium was found in the 12- to 18-inch depth.

EFFECT OF CHLORIDE VERSUS SULFATE IONS ON NUTRIENT-ION ABSORPTION BY PLANTS

By A. E. Kretschmer, S. J. Toth, and F. E. Bear. Soil Sci. 76: 193-199. 1953.

A study was made of effect of variation in Cl and SO_4 contents of substrate on ion variation and yield of plants, and of translocation of Cl³⁶ in plants. It was found that variations in SO_4 content of substrate had little effect on plant content of SO_4 or on absorption of other ions.

Increasing Cl content of substrate resulted in linear increase in Cl content of plant, this effect being independent of substrate or plant species.

CONSERVATION AND UTILIZATION OF SOIL MOISTURE

By C. E. Fisher and E. Burnett. Tex. Agr. Expt. Sta. Bul. 767. 1953.

Results of 27 years of research at Substation No. 7 near Spur, Tex. on moisture conservation studies are reported. Crop production on the heavy soils of the rolling plains is chiefly governed by the amount of water available for plant growth.

Soil fertility seldom influences crop yields, except on the lighter sandy soils when rainfall and soil moisture are more favorable. Since available moisture limits crop production, major emphasis is placed on factors that influence the accumulation and utilization of soil moisture.

COMPARISON OF BIOLOGICAL TESTS FOR ASSAYING FERTILITY OF PUNJAB SOILS

By A. Wahhab and A. S. Bokhari. Soil Sci. 76: 323-330. 1953.

The biological method of determining the fertility of a soil was compared with the chemical method. Five typical soils of varying degrees of fertility were used. It was concluded that Mitscherlich's pot culture method and the Aspergillus niger test gave fairly reliable information as to the nutrient status of the soils.

Structure Control

CHANGES IN AIR-WATER RELATIONSHIPS DUE TO STRUCTURAL IMPROVEMENT OF SOILS

By V. C. Jamison. Soil Sci. 76: 143-151. 1953.

It is concluded that only with coarse-textured soils will increases in organic matter consistently result in available water-capacity increases. "Air capacities," "available water capacities," and "wilting points" were measured through moisture-tension determinations for soils covering a wide range of texture.

These data show that the structural improvement of a soil generally increases air capacity but decreases available water capacity. Under field conditions, however, structural improvement influences soil-water relation because aggregate stabilization promotes increased infiltration of water.

THE CASE FOR SLUDGE AS A SOIL IMPROVER

By H. A. Lunt. Water and Sewage Works. 1953.

Studies show conclusively that, under conditions of the experiments, digested sewage sludge from typical treatment plants in Connecticut has a

very favorable effect on the properties of soil. This was evidenced by moderate increases in field moisture capacity, noncapillary porosity, and cation-exchange capacity; in organic-matter content, in total nitrogen, and in soil aggregation.

As a rule, greater benefits occur in sandy soil than in loams.

A COMPARISON OF FIVE METHODS FOR EXPRESSING AGGREGATION DATA

By F. W. Schaller and K. R. Stockinger. *Soil Sci. Soc. Amer. Proc.* 17: 310-313. 1953.

Five ways of expressing aggregation data have been used in recent years. These are: percent aggregates greater than 2 mm., 1 mm., and 0.25 mm. and geometric mean and mean weight-diameter. To determine the advantages or disadvantage of the several indices, aggregation results obtained by the Yoder method on several hundred soil samples from three locations in Iowa have been compared. Correlation coefficients were obtained between the mean weight-diameter and the percent of aggregates > 2 mm., > 1 mm., and > 0.25 mm., and also the geometric mean.

The geometric mean was also correlated with the three size separates. The results indicate that a single size fraction such as the > 2 mm. or > 1 mm. can be satisfactorily used to express soil aggregation. This method of expression would be as reliable (to within the 1-percent level of significance) as that indicated by the two indices, mean weight-diameter and geometric mean, which utilize all size fractions.

It, however, was shown that more replications are necessary for equal accuracy when only a single size fraction is used. If time is to be saved in making the laboratory determinations, it is suggested that a size fraction such as the > 2 mm. or > 1 mm. might be determined more quickly and with greater accuracy by developing a method using one or two sieves and a larger soil sample. The final selection of an index for expressing soil aggregation must be based on the ability of the index to correlate with crop response.

FACTORS THAT INFLUENCE CLOD STRUCTURE AND ERODIBILITY OF SOIL BY WIND: II. WATER-STABLE STRUCTURE

By W. S. Chepil. *Soil Sci.* 76: 389-399. 1953.

A detailed study was made of the relative influence of the various phases of water-stable structure on clod structure and erodibility by wind. An inverse relation was found between soil erodibility by wind and the percentage of water-stable particles < 0.02 and > 0.84 mm. in diameter.

Water-stable particles between 0.02 and 0.05 mm. and between 0.42 and 0.84 mm. tended to reduce erodibility, but only slightly compared with those < 0.02 mm. and > 0.84 mm. Water-stable particles between 0.05 and 0.42 mm., on the other hand, tended to increase soil erodibility.

A METHOD FOR DETERMINING THE STABILITY OF SOIL STRUCTURE BASED UPON AIR AND WATER PERMEABILITY MEASUREMENTS

By R. C. Reeve. *Soil Sci. Soc. Amer. Proc.* 17: 324-329. 1953.

A method is described for determining the stability of soil structure based upon intrinsic permeability, the measurement being made first with air and then with water. The change in permeability is attributable to the instability of the soil to the wetting and slaking action of the water.

Procedures and equipment for making tests with fragmented samples are described. Experimental data, showing the permeability ratio of air to water is correlated with treatments known to produce differences in structural stability and are presented for both fragmented samples and soil cores. The air-water permeability ratio is correlated with both the exchangeable sodium percentage and clay content of the soils. The effect of a polymeric soil conditioner of the type VAMA (Vinyl acetate-maleic acid) in stabilizing the structure of alkali soils is reflected in the permeability ratio determination. The permeability ratio for soils varies over a range of from slightly greater than 1 to 10,000 or more. This large range permits effective appraisal of soil treatments that affect soil stability. On the basis of the reported tests, it appears that at the 20-to-1 level of odds, single determinations of the permeability ratio will distinguish a 45-percent difference for fragmented samples and a 185-percent difference for cores.

The permeability ratio expresses in a single dimensionless number the effects of many factors and processes that influence the stability of soil structure. It is an integrated measure of the effects of swelling, slaking, dispersion, and other processes taking place to change soil structure as a result of wetting with water.

Irrigation

BUTYL FABRICS AS CANAL LINING MATERIALS

By C. W. Lauritzen and W. H. Peterson. *Utah Agr. Expt. Sta. Bul.* 363. 1953.

The results of aging in a soil compost and exposure to weathering indicate that butyl fabrics will be highly resistant to deterioration from biological activity and the agents of weathering such as sunlight and temperature.

HYDROCYANIC ACID CONTENT OF CERTAIN SORGHUMS UNDER IRRIGATION AS AFFECTED BY NITROGEN FERTILIZER AND SOIL MOISTURE STRESS

By C. E. Nelson. *Agron. Jour.* 45: 615-617. 1953.

An experiment was conducted to determine the HCN content of Early Hegari and Double Dwarf Sooner grain sorghums and Black Amber forage

sorghum under certain moisture conditions and fertility levels. The wilting of normally growing sorghums or the use of a high rate of nitrogen fertilizer increased the HCN content of the plant material sampled before heading. The grain sorghums contained more HCN than Black Amber forage sorghums.

The HCN content of the second growth of the above varieties and Sudan grass was determined under one moisture level. The previous moisture treatment did not influence the HCN content of the plants.

The experiment showed that green plant material from the two grain sorghum varieties, Early Hegari and Double Dwarf White Sooner, under certain conditions, can develop sufficient HCN to be poisonous to cattle.

UNSTEADY FLOW IN OPEN TYPE PIPE IRRIGATION SYSTEMS

By E. H. Taylor, A. F. Pillsbury, T. O. Ellis, and G. A. Bekey. Amer. Soc. Civil Engin. Proc. 79: Separate No. 369. 1953.

Severe "surging" has presented a serious operating difficulty in parts of the Coachella Valley (Calif.) County Water District's irrigation distribution system. A model study of the mechanics of surge amplification is described, and a mathematical analysis of the phenomenon is presented. The use of properly placed vent pipes is suggested as a practical method of controlling surging. The mathematical analysis is felt to be of interest because it was done mechanically.

The application of the University of California's differential analyzer to this problem is described. The agreement between the theoretical and the observed results is generally satisfactory although certain questions remain to be answered.

PRODUCTION PRACTICES FOR IRRIGATED CROPS ON THE HIGHPLAINS.

By A. C. Magee, C. A. Bonnen, W. C. McArthur, and W. F. Hughes. Tex. Agr. Expt. Sta. Bul. 763. 1953.

Under irrigation, the trend in farming on the High Plains has been to increase the emphasis on cash crop production. Data concerning production and production requirements for the crops commonly grown under irrigation on the High Plains are shown and discussed. Under production requirements are the use of items such as irrigation water, seed, fertilizer, insecticides, and other materials, as well as seasonal labor, custom work, and other hired services.

Also included are the usual field operations and the labor and power requirements for each crop. The requirements with both 2- and 4-row equipment are discussed for all row crops. Data for both sandy and heavy soils are shown.

CONSUMPTIVE USE OF WATER AND IRRIGATION REQUIREMENTS

By W. D. Criddle. Jour. Soil and Water Conserv. 8: 207-212+. 1953.

Consumptive use (or evapotranspiration) includes loss of water by evaporation from the surface of the soil and loss from interception by vegetative cover and plant transpiration. This paper discusses the factors affecting consumptive use, research studies of the problem, and methods of measuring and estimating consumptive use of agricultural crops.

Nomographs are presented for quickly determining monthly consumptive-use rates, peak daily-use rates and required flow rates for use in designing irrigation systems.

EFFECTS OF IRRIGATION LEVEL ON COTTON AT PECOS, 1952

By L. S. Stith and P. J. Lyerly. Tex. Agr. Expt. Sta. Prog. Rpt. 1607. Sept. 9, 1953.

This test demonstrated the critical need of water during fruiting, and that a water stress may reduce yield and boll size, shorten staple length, increase lint percent, and increase fiber strength.

A GRAPHIC SOLUTION FOR SIPHON TUBE IRRIGATION PROBLEMS

By J. E. Garton and V. L. Hauser. Okla. Agr. Expt. Sta. MP-30. 1953.

A rapid method is provided for determining the number of siphons needed or the head needed in the field ditch for a given rate of water flow. A graphic solution and simple instructions, along with examples, explain how to figure easily and quickly the size of a siphon tube, the number of second-feet of water being delivered to a farm, and the head.

The graph is designed primarily for use on inside diameter siphons; however, some curves using outside diameter tubes are shown.

Erosion Control

FIELD STRUCTURE OF CULTIVATED SOILS WITH SPECIAL REFERENCE TO ERODIBILITY BY WIND

By W. S. Chepil. Soil Sci. Soc. Amer. Proc. 17: 185-190. 1953.

A study of structure and erodibility of soil by wind was carried out on wind-eroded and residual soil materials in a condition usually existing in the field and after sampling, cultivating, and dry sieving.

Field structure and erodibility of soils varied greatly with as little as 1 inch of simulated rainfall. In soils undisturbed by cultivation after rain, four distinct phases of structure were found, all of which possess different degrees of erodibility by wind. These phases are the primary aggregates (water-stable aggregates), the secondary aggregates (granules and clods), the surface crust, and the consolidated soil material between the secondary aggregates.

The abrasive action of wind erosion was shown to be one of the most serious aspects of erodibility by wind. The mechanical stability, that is, the resistance of a soil to breakdown by mechanical forces such as cultivation or sieving, varied directly with the resistance of the soil to abrasion by wind-blown sand. Mechanical stability was greatest for drift particles (sand grains and waterstable aggregates mostly), less for the secondary aggregates, followed in order by the surface crust, the consolidated materials between the secondary aggregates, and lastly the consolidated materials, if any, which held drifted particles together after they were wetted and dried.

The amount of dispersed fine silt was found to be a primary factor influencing the formation of the surface crust and the consolidation of the soil body after it was wetted and dried. A fraction of clay size, being much less dispersible than silt, was the primary factor of secondary aggregate formation. Water-dispersible silt and clay were responsible in large measure for the resistance of the soil to erosion by wind. Although the amount of erosion was limited to some degree by the presence of water-stable aggregates too large to be moved by wind, it was found that cultivated dryland soils lack these aggregates in sufficient amounts. The resistance of these soils to wind action was found to depend primarily on their ability to form secondary aggregates, or clods.

The secondary aggregates preserved their identity below the surface even after repeated wetting and drying in the field. It was concluded, therefore, that the physical condition of the soil is indicated as well or better by methods such as dry sieving, which primarily measure the state of the secondary aggregates, than by methods that measure the state of the primary aggregates.

WIND-EROSION CONTROL

By J. H. Stallings. U. S. Dept. Agr. SCS-TP-115. 1953.

Wind erosion is caused primarily by the saltation movement of soil particles ranging from 0.1 mm. to 0.5 mm. in diameter. The way to prevent this movement is either to aggregate the soil so that the soil aggregate exceed the 0.5 mm. diameter or reduce the wind velocity at the surface of the ground sufficiently that it cannot start the saltation movement.

Correct use of plant cover will achieve both of these objectives. This paper explains how this can be done on a practical farm basis.

STUDIES ON THE RELATION BETWEEN THE KIND OF CROP AND SOIL EROSION

By K. Matsuoka and M. Kawakami. Bul. Shikoku Agr. Expt. Sta. Ministry of Agr. and Forestry. Japan. 1: 18-22. 1953.

Here was determined the effect of a number of crops, including sweet potatoes, corn, soybeans, peppermint, pyrethrum, ramie, *Hibiscus Japonicus*, lovegrass, lespedeza, on erosion on a 15 percent slope.

Lovegrass and pyrethrum were more effective in controlling erosion at all growth stages than the other crops used. They were followed in order by lespedeza or peppermint. Erosion occurred in a decreasing order on the following crops: corn, soybeans, ramie, and *Hibiscus Japonicus*. The rate of erosion was the same for corn, sweet potatoes, and soybeans during the early part of the growing season. When the cover became more than 50 percent effective, sweet potatoes became more effective than the other crops in controlling erosion. When fully grown, the sweet potatoes were as effective as lovegrass.

It was shown that the more erect the plants are the lower is their erosion control value, regardless of height of crops and coverage.

SELECTIVE LOSS OF PLANT NUTRIENTS BY EROSION

By N. L. Stoltzenberg and J. L. White. Soil Sci. Soc. Amer. Proc. 17: 406-410. 1953.

Erosion on six 3-acre watersheds under prevailing farming practices and six 3-acre watersheds under a conservation farming system was found to be a selective process. The eroded material contained considerably more plant nutrients than the soil from which it eroded. This selective process resulted in a decrease in soil fertility, a decrease in organic matter, and changes in texture, due to energy limitations of the runoff.

It was found that as selective erosion progressed, the availability of certain soil fractions may be changed, which limited the selection. For areas under cultivation the effects of selective erosion were accentuated by increases in the availability of the more valuable soil constituents as a result of plowing, cultivation, or rill development.

ANALYSIS OF WIND EROSION PHENOMENA IN ROOSEVELT AND CURRY COUNTIES, NEW MEXICO

By A. W. Zingg, W. S. Chepil, and N. P. Woodruff. AGR, SCS-Albuquerque, New Mex. M-436. 1953.

The rating of surface and cover conditions brings out the fact that the poorest protection exists on the soils of coarsest texture and vice versa. At the same time, the coarser soils are basically the most erodible.

Plant residue has several other properties besides its kind and weight. Its orientation,

density, and height are important. Where sorghum stubble is about 1 foot high it is effective provided it has sufficient density to cause the wind to flow over the stubble rather than through it. The amount of leaves present on the stubble appears to have considerable effectiveness. The use of varieties tending to produce and retain leaves near the ground should be encouraged. Delaying fallowing operations on wheat-stubble land until after spring winds are past appears to be one of the best methods of soil protection.

Where clods brought up by the chisel are too isolated and massive, emergency controls are not too effective. The wind may flow around them and be concentrated on the erodible portions of the soil. Better protection would be obtained with an equivalent weight of clods of somewhat smaller size. Other factors being equal, erodibility of a soil by wind is dependent primarily on the proportion of erodible factors present at its surface in a dry state. Few soil particles moved by wind exceed 0.84 mm. in diameter.

MECHANICS OF WATER EROSION

By J. H. Stallings. U. S. Dept. Agr. SCS-TP-118. 1953.

Falling raindrops and flowing surface water are the two chief erosive agents in the water-erosion process.

Raindrops serve chiefly to detach soil particles. Transportation of the soil particles is mainly by surface flow of water. Although the primary role of the falling raindrops in the erosion process is detaching soil particles, they play a secondary role which often is equally as important. During heavy impact storms on unprotected land, they splash large quantities downhill and also impart transporting capacity to surface water by keeping it turbid.

The energy of falling raindrops is applied vertically downward while that of surface flow is usually applied parallel to the surface. Falling drops and surface flow produce widely different effects on the soil. Raindrop splash, or the splash-erosion process, removes the sloping top-soil in thin sheets. It acts as a smoothing and leveling agent. It produces at least three important types of damage, that is, puddle erosion, fertility erosion, and sheet erosion. Flowing surface water erodes by scouring or grooving the soil. It is a roughening agent and is responsible for rill and gully formation.

EFFECT OF 39 YEARS OF CROPPING PRACTICES ON WIND ERODIBILITY AND RELATED PROPERTIES OF AN IRRIGATED CHESTNUT SOIL

By A. P. Maxurak, A. W. Zingg, and W. S. Chepil. Soil Sci. Soc. Amer. Proc. 17: 181-185. 1953.

In April, 1951, a portable wind tunnel was set up at the Scottsbluff, Nebr., Substation on plots that were planted to sugar beets and potatoes. The soil losses from wind under controlled condi-

tions were measured on manured and nonmanured plots from (1) a 3-year rotation of barley, potatoes and sugar beets, and (2) a 6-year rotation of barley with alfalfa 3-years, potatoes, and sugar beets. On these and other plots, size-fractions of air-dried clods from the surface 2 inches of soil were separated by means of rotary sieves. Each size-fraction was analyzed for the apparent density of clods, total nitrogen content, and moisture content at 15-atmosphere tension.

The cropping and manurial practices showed a marked effect on the soil losses from wind. Alfalfa in the rotation was superior to manure application in reducing soil losses. Application of 12 tons of barnyard manure on potato plots in a 3-year rotation reduced the soil loss from 74,500 pounds per acre to 2,720. The soil loss on non-manured plots in the 6-year rotation was 970 pounds per acre. The beet plots, in a cropping system and manurial application similar to potato plots showed a smaller regimen of soil losses.

Mechanical stability of clods was determined by their resistance to breakdown as a result of resieving. It was greatest in plots cropped to continuous barley, followed in order by beets, corn, and potatoes. Mechanical stability was greater in manured than in nonmanured plots.

The application of manure or growing of alfalfa in the rotation effected a marked reduction in the apparent density of clods and increased the total nitrogen content and the moisture content at 15-atmosphere tension. Alfalfa was superior to manure in effecting these changes in soil properties.

Cropping Systems

NITROGEN STATUS OF MARSHALL SILT LOAM AS INFLUENCED BY DIFFERENT CROP ROTATIONS

By R. M. Andharia, G. Stanford, and F. W. Schaller. Soil Sci. Soc. Amer. Proc. 17: 247-251. 1953.

A study to compare the effects of several different crop rotations on crop yields and on certain physical and chemical properties of the Marshall silt loam soil has been underway in Iowa since 1942. The objective in the present study was to evaluate the relative nitrogen status of the plots planted to corn in 1951 as revealed by content of soil organic matter and total nitrogen, nitrification studies, and nitrogen content of the corn leaf. Corn plots, in rotations which included one or more years of meadow, contained significantly higher amounts of organic matter and nitrogen than did plots in the corn-oats rotation. Marked differences in yield between first- and second-year corn occurred in various rotations, although the organic-matter content of these plots were the same. Nitrate release on incubation of soils and content of leaf nitrogen clearly reflected the relative nitrogen availability under first- and second-year corn.

Considering all rotations, a highly significant relation was found between corn yields and nitrogen content of the sixth corn leaf. The value of studying leaf nitrogen as well as nitrification

rate as a means of periodically evaluating the soil nitrogen status in rotation experiments is discussed and illustrated.

STUDIES OF THE CROPPING SYSTEM ON THE HILLSIDE FARM: I. IN RELATION TO SURFACE RUNOFF AND EROSION

By K. Ito, K. Matsuoka, and K. Kawakami. Bul. Shikoku Agr. Expt. Sta. Ministry of Agr. and Forestry. Japan. 1: 10-17. 1953.

The purpose of this study was to determine the effect of lespedeza and soybeans (used for green manure) or volunteer grass on the conservation of soil in cropping systems of wheat, corn-wheat, and sweet potatoes. The most serious erosion occurred on corn following wheat. Here erosion occurred throughout the growing season. Erosion was heavy on the sweet potatoes during the early part of the growing season but declined rapidly as the vines covered the ground.

Lespedeza interplanted with corn controlled erosion and surface runoff and speeded up the growth of corn during the early part of the growing season. The lespedeza increased the surface intake of water and made more moisture available to the corn plants. However, the lespedeza competed with corn for soil moisture later in the season.

Soybeans intercropped with sweet potatoes were effective in controlling erosion and reducing runoff when they were cut and used as a mulch.

Residue Management

CORN RESIDUES PROTECT SOIL

By G. N. Sparrow. Ga. Agr. Expt. Sta. Research News. 1953.

Corn residues, together with the weeds and grasses that grow during the latter part of the season, provide excellent protection to the soil during the fall, winter, and early spring. It may not always be necessary to look for new plants and new methods of farming to conserve soil adequately.

Perhaps new slants on the way things are already being done may solve some of the problems facing farmers who are losing soil and water from their cultivated fields.

INFLUENCE OF RATE OF PLANT RESIDUE ADDITION IN ACCELERATING THE DECOMPOSITION OF SOIL ORGANIC MATTER

By M. J. Hallam and W. V. Bartholomew. Soil Sci. Soc. Amer. Proc. 17: 365-368. 1953.

The addition of corn and soybean residues to soils increased the rate of decomposition of the native soil organic matter. The residues were comparable to green-manure crops and the data provide an explanation for the failure of green manures to be helpful in building or maintaining

the organic-matter content of soils. Plant materials containing radioactive carbon were added to soils at the rates of 2.5, 10, and 50 tons per acre. The use of the isotopes permitted a partition of the evolved CO_2 into that coming from the plant residue and that coming from the soil organic matter. The high rates of residue addition resulted in greater losses of native soil organic matter than did the low rate. Corn and soybeans were similar in their influence on the decomposition of soil carbon.

The rate of plant residue addition had a marked influence upon the rate of residue decomposition. At the rate of 2.5 and 10 tons per acre, the decomposition of residue was considerably more rapid than when added to soil at the rate of 50 tons per acre. Residues apart from soil decomposed at about the same rate as when added to soil at the rate of 50 tons per acre.

Tillage and Cultural Practices

NITRIFICATION IN AN ORCHARD SOIL UNDER THREE CULTURAL PRACTICES

By I. L. Stevenson and F. E. Chase. Soil Sci. 76: 107-114. 1953.

This study determined the effect of mulch, sod, and clean cultivation on the nitrifying capacities of a soil under these treatments for 4 years. It was assumed that the nitrifying capacity reflects the field activity, and further, that any differences found between soils were caused by a particular treatment. Different nitrifying capacities resulted in these treatments.

Indications were that the mulched soil maintains a nitrifying population at a near-maximum level. Addition of lime resulted in a significant increase in the nitrifying capacity of soils under all treatments except mulch. Possible explanations are suggested.

MICROBIOLOGY STUDIES OF STUBBLE MULCHING

By T. M. McCalla. Nebr. Agr. Expt. Sta. Bul. 417. 1953.

Studies were started in 1941 on some of the soil microbiology problems involved in stubble mulching. Studies have been made of the rate of decomposition of different types and amounts of residues under both laboratory and field conditions. Microorganisms were found to affect soil structure stability and water intake. A study of the types, number, and position of microbial population with stubble mulching shows a greater number of the aerobic types of microorganisms developing in the surface inch of soil. The number of denitrifying organisms was slightly higher with stubble mulching. Because of the lower temperatures and higher moisture content, the number of earthworms was significantly higher with stubble mulching than in plowed land.

Available nitrogen in the field was 5 to 10 percent less with stubble mulching than with plowing. Nitrite nitrogen was low in stubble mulching and the same as with plowing. Ammonia losses during decomposition on the surface of the soil were insignificant with residues such as wheat straw. Amounts of less than 5 pounds per acre were lost with sweetclover.

SOIL MIXING CHARACTERISTICS OF TILLAGE IMPLEMENTS

By W. C. Hulbert and R. G. Menzel. Agr. Engin. 34: 702-708. 1953.

Radioactive phosphorus and sorghum grains were used to study the mixing of soil by various tillage operations. All shallow-tillage operations tested mixed the tracer material with the surface soil to a depth of less than one inch.

Deep tillage operations varied enormously in uniformity of mixing tracer material with the surface 6 inches of soil.

EFFECT OF ROTATIONS, FERTILIZERS, LIME AND GREEN MANURE CROPS ON CROP YIELDS AND ON SOIL FERTILITY

By L. G. Thompson, Jr., and W. K. Robertson. Fla. Agr. Expt. Sta. Bul. 522. 1953.

Field plots in replicated randomized blocks were established on virgin soil consisting mostly of Norfolk loamy fine sand to determine the effect of various rotations and continuous crops, fertilizers, lime, and green-manure crops on yield of peanuts, corn, and oats and on the fertility of the soil.

Corn grown in rotation with green-manure crops yielded significantly higher than continuous corn with native cover. Peanuts grown in rotation with corn and green-manure crops yielded an average of about 100 to 200 pounds per acre more than continuous peanuts. In 1952, continuous lupine following peanuts yielded 2,200 pounds per acre of green weight, compared with 8,371 pounds for lupine grown once in a 3-year rotation.

Equipment

A FOUR-ROW PLOT SEEDER

By W. E. Smith, J. E. Fitzsimmons, and J. Rawlings. Canad. Jour. Agr. Sci. 33: 394-395. 1953.

Improvements and modifications of the Grafius type four-row small grain seeder are described. The machine is similar in construction to the Grafius type seeder but differs mainly in that it has a centrifugal type of divider similar in operation to the cyclone grass seeder.

The seeding unit is mounted on a 5-horsepower riding type garden tractor which can also be used for cultivation.

CROPS

General

AVAILABLE MOISTURE FOR CROPS

By L. L. Harrold. Agr. Engin. 35: 99-101. 1954.

One of the first steps in determining total amount of moisture readily available for use by a crop is to determine the depth of soil from which the crop withdraws most of its water. Extraction patterns have been developed by dividing the root depth into quarters and calculating the percentage of the total amount of water extracted that came from each quarter.

A typical, and somewhat commonly used, extraction pattern is: Top quarter 40 percent; second quarter, 30 percent; third quarter, 20 percent; and bottom quarter of root depth, 10 percent.

EFFECT OF VARIOUS METHODS AND RATES OF NITROGEN APPLICATION ON SEED YIELD OF SWITCHGRASS (PANICUM VIRGATUM L.)

By J. R. Harlan and W. R. Kneebone. Agron. Jour. 45: 385-386. 1953.

Tests conducted in 1950 showed that ammonium nitrate fertilizer applied at rates of 10, 20, and 40 pounds of nitrogen per acre, increased seed production of switchgrass. Whether these rates were drilled at one time or split into several applications, seed yields were comparable for 20- and 40-pound rates.

Spraying inorganic nitrogen in five applications gave comparable effects to drilling it.

Field Crops

DARSET; A COMBINE-TYPE DARSO

By F. F. Davies and J. B. Sieglinger. Okla. Agr. Expt. Sta. Bul. B-391. 1953.

Darset was developed in the Station's sorghum breeding program to meet the need for a combine-type grain sorghum resistant to damage by birds and weathering. The average height of Darset is 15 inches less than that of Oklahoma No. 1 Darso, 8 inches less than Martin, and 11 inches less than Redlan. Grain production of Darset in the 1952 performance tests was approximately equal to that of Oklahoma No. 1 Darso.

Darset matures a week to 10 days earlier than regular darso, is resistant to Periconia stalk rot, and will remain standing under conditions that produce lodging of regular darso. Other information concerning the performance, description, and origin of this new sorghum is given in the bulletin.

MOISTURE AVAILABLE TO VARIOUS CROPS IN SOME NEW JERSEY SOILS

By A. T. Corey and G. R. Blake. Soil Sci. Soc. Amer. Proc. 17: 314-317. 1953.

Moisture available to wheat, potatoes, tomatoes, and sweet corn was determined by combining moisture-retaining characteristics of soils and the depths to which crops exploit the water reservoir. Available water in a unit depth varied with soil type and with horizon in a given soil type.

Effective rooting depth of a crop was defined as the maximum depth to which soil continued to lose moisture after a prolonged period of rainless weather. Moisture samples determined gravimetrically were each referred to a standard of 100 cm. water tension to give relative wetness values. When depth vs. relative wetness was plotted, effective rooting depth was a clearly defined point below which significant quantities of water were obtained by plants.

Effective rooting depth of sweet corn varied with soil type from 11 to 35 inches. It also varied on a given soil with kind and age of crop. When differences in rooting depth were combined with moisture in unit depth, tomatoes had about four times as much water at their disposal in Sassafras loam as in Nixon loam. Wheat had less than half as much as tomatoes when both were growing on Sassafras loam.

SULFUR NUTRITION IN FLUE-CURED TOBACCO

By I. Neas. Agron. Jour. 45: 472-477. 1953.

Omitting the sulphate from the fertilizer resulted in pronounced sulphur deficiency symptoms in 1950 and noticeable deficiency in 1951 during dry periods early in growth. These deficiency symptoms disappeared following rains.

The data indicate that smaller amounts of sulphate would be desirable in tobacco fertilizer and that the amount should be kept as low as would be economically practical.

INFLUENCE OF ROW WIDTHS AND SEEDING RATES ON YIELD AND SURVIVAL OF TALL FESCUE STANDS

By E. C. Holt. Tex. Agr. Expt. Sta. Prog. Rpt. 1601. 1953.

The two tests presented indicate that tall fescue survival can be increased by planting in rows at least 14 inches wide or wider, with no sacrifice in forage yield, and that higher yields may be obtained. Row plantings also would make easier the establishment of a legume with the grass.

Results also indicate that 10 pounds of seed per acre are adequate for obtaining good stands of tall fescue in 7-inch drill rows, and that 5-10 pounds may be used in rows 14 inches or wider. There is also an indication that solid stands in 7-inch drill rows are not needed for maximum

yields, but that near solid stands in wider rows are needed for best results. Heavier seeding rates will result in earlier forage the first season but this is not reflected in the second season.

EFFECTIVENESS OF SOIL FUNGICIDES IN CONTROLLING COTTON SEEDLING DISEASES IN THE LOWER RIO GRANDE VALLEY

By G. H. Godfrey. Tex. Agr. Expt. Sta. Prog. Rpt. 1602. 1953.

Substantial and significant results were obtained from soil treatments with some of the fungicides applied at planting time. Outstanding in effectiveness was Mathieson-275 with 20 percent active pentachloronitrobenzene applied as a dust at the rate of 25 pounds per acre.

The combined effect of increased initial stand and reduced postemergence damping-off gave a 52 percent higher final stand than in the checks. The season was dry and the incidence of damping-off not as high as it had been in the experimental area in moist seasons. The residual effectiveness of this and other chemicals in a wet season remains to be determined.

EFFECT OF POTASH FERTILIZATION ON YIELD, STALK BREAKAGE AND MINERAL COMPOSITION OF CORN

By H. Wittels and L. F. Seatz. Soil Sci. Soc. Amer. Proc. 17: 369-371. 1953.

A corn hybrid with known susceptibility to stalk breakage was grown to determine the influence of time and rate of potash fertilization at two rates of nitrogen on yield, amount of stalk breakage, and on the potassium and calcium composition of portions of the plants sampled periodically during the growing season. Certain of the potash-treated plots yielded significantly more than the no-potash plots but the trend was not consistent. Stalk breakage was reduced by potash applications at the high nitrogen level but not at the low nitrogen level. At the high nitrogen level up to 40 pounds K₂O per acre reduced stalk breakage and higher rates had no further effect.

The potash content of the plants was directly related to the rate of potash applied and for each treatment was approximately the same at the two nitrogen levels. Three methods of potash application showed no difference in their effect on the factors studied. A reciprocal relation was noted between the potassium and calcium content of the plants. A tendency toward cation equivalent constancy at the later stages of growth was observed.

THE EFFECT OF GRAZING MANAGEMENT ON FORAGE AND GRAIN PRODUCTION FROM RYE, WHEAT AND OATS

By M. A. Sprague. Agron. Jour. 46: 29-33. 1954.

The purpose of this study was to determine the potentials of winter rye, winter wheat, and winter

oats for the production of both pasturage and grain and to ascertain the effect of grazing management on such productions.

In this 4-year study with dairy cows, rye, wheat, and oats yielded forage in approximately a 3, 2, 1 relations. Fall and spring pasture production from rye was about 75 percent as much as from a Kentucky bluegrass-white clover pasture on the same land from May to October. Grain production was increased by fall grazing and decreased by grazing in spring.

THE FEEDING POWER OF PLANTS FOR PHOSPHATES

By M. Fried. *Soil Sci. Soc. Amer. Proc.* 17: 357-359. 1953.

Plant species were compared as to their feeding power for both monocalcium phosphate and rock phosphate. Even after the effect of size and extensive area of the root absorbing surface was eliminated, species differed in their capacity to absorb phosphorus from basic calcium phosphates.

The phosphorus of rock phosphate was more available to the legumes, alfalfa, crotalaria, and ladino clover, than to the grasses, orchardgrass, bromegrass, perennial ryegrass, millet, and oats.

FOLLAR FEEDING OF CORN WITH UREA NITROGEN

By C. D. Foy, G. Montenegro and S. A. Barber. *Soil Sci. Soc. Amer. Proc.* 17: 387-390. 1953.

The application of supplemental nitrogen to corn by the use of urea foliar sprays was investigated. Injury in the form of marginal leaf burn was dependent upon both the concentration of the solution and the rate of application. The amount of injury could also be modified by additions of sugar, calcium hydroxide, and potassium bicarbonate. Yield response of corn to foliar applied nitrogen was no greater than to the same amount of nitrogen applied as a sidedressing. When injury occurred, the yield response was reduced.

The cause of marginal leaf burn was investigated. Ammonia or nitrites did not appear to cause the injury. It was postulated that some product or a number of products of ammonia metabolism caused the injury. The beneficial effect of sucrose was believed to be due to the decreased rate of urea absorption and an increased rate of urea translocation within the plant.

CHEMICAL COMPOSITION OF TOBACCO LEAVES AS AffECTED BY SOIL MOISTURE CONDITIONS

By C. H. M. van Bavel. *Agron. Jour.* 45: 611-614. 1953.

Flue-cured tobacco was grown in North Carolina under conditions where the maximally occurring soil-moisture tension could be controlled with overhead irrigation. Three moisture regimes were established. The experiment also included two lime levels and two levels of fertilizer addition.

Soil-moisture tension was found to greatly affect the chemical composition of the leaves.

Low tension (high moisture content) gave lower content in the cured leaves of nicotine, total nitrogen, CaO and MgO, but a higher content of sugars, as well as better burning characteristics, higher yield and higher market value. Potassium content was ambiguously affected, being high for dry conditions but low for an intermediate condition. Interaction with the lime and fertilizer level was slight. Differences in nicotine content and market value were more pronounced at the high lime level and differences in potassium content were more outstanding at the high rate of fertilization.

INFLUENCE OF ATMOSPHERIC HUMIDITY ON ROOT GROWTH

By E. L. Breazeale and W. T. McGeorge. *Soil Sci.* 76: 361-365. 1953.

The effect of humid and arid environment on root elongation was studied. It was shown that a significant relation between the humidity of the atmosphere surrounding the aerial part of the plant and the rate of root elongation in corn and tomato plants existed.

Absorption of moisture through the leaves actively stimulates root growth.

RICE--SOIL CONSERVING OR SOIL DEPLETING?

By V. E. Green, Jr. *Soil Sci. Soc. Amer. Proc.* 17: 283-284. 1953.

A review of the literature shows that the soil-rice plant-water system of rice culture throughout the world has resulted in subsistence yields of rice grain for 4,000 years. The system has also resulted in the maintenance of nitrogen and organic-matter content of the soil, the prevention of soil erosion through the level terrace system of rice culture, the maintenance of soil structure and a more rapid release of soil minerals. These beneficial effects are obtained only when the rice is grown on flooded soil.

Dryland rice is comparable to the other small grains in their effects on the soil. Flooding un-planted soil has been shown to be deleterious to the nitrogen supply. In the Everglades region of Florida, flooded soils alternately planted to rice seem to be the only recourse to prevent a complete disappearance of the muck and peat by the year 2000.

RESPONSE OF COASTAL BERMUDA GRASS TO FERTILIZERS

By H. W. Gausman and W. R. Cowley. *Tex. Agr. Expt. Sta. Prog. Rpt.* 1639. 1954.

The effects of different rates of N and P₂O₅ on the production of air-dried forage in tons per acre are given. N was the only fertilizer which significantly increased the yield. This increase was roughly doubled for all plots which received

160 pounds per acre of N over plots which received no nitrogen.

The increase in yields of plots which received 160 pounds per acre of N over those which received 80 pounds of N was approximately 2 tons of air-dried forage per acre. Coastal Bermuda did not respond significantly to application of P₂O₅.

Pasture and Range

PRODUCTION AND QUALITY OF IRRIGATED PASTURE MIXTURES AS INFLUENCED BY CLIPPING FREQUENCY

By M. L. Peterson and R. M. Hagan. Agron. Jour. 45: 283-287. 1953.

Four irrigated pasture mixtures were harvested at intervals of 2, 3, 4, and 5 weeks over a 3-year period. Results were measured in terms of total seasonal yield, seasonal growth curves, botanical composition, and chemical composition. All mixtures increased in yields as growth intervals were extended from 2 to 5 weeks.

METHODS OF SUPPLYING PHOSPHORUS TO RANGE CATTLE IN SOUTH TEXAS

By E. B. Reynolds, J. M. Jones, J. H. Jones, J. F. Fudge, and R. J. Kleberg, Jr. Tex. Agr. Expt. Sta. Bul. 773. 1953.

An experiment was conducted on the Encino division of the King ranch near Falfurrias from 1941 to 1946 to determine the most practical methods of supplying phosphorus to range cattle and to determine the effect of applications of different phosphates on the yield and chemical composition of pasture forage.

Phosphorus was supplied to cattle by feeding bonemeal in self-feeders, by adding disodium phosphate to controlled water supply and by fertilizing pasture with triple superphosphate.

The results show conclusively that the cattle will get the necessary phosphorus where any of these methods is used.

EFFECTIVENESS AND RECOVERY OF PHOSPHORUS AND POTASSIUM FERTILIZERS TOPDRESSED ON MEADOWS

By J. Hanway, G. Stanford, and H. R. Meldrum. Soil Sci. Soc. Amer. Proc. 17: 378-382. 1953.

A 2-year experiment was conducted in which phosphorus and potassium fertilizers were top-dressed each year on an alfalfa-timothy meadow. In 1950, rates of 0, 60, and 120 pounds per acre of P₂O₅ and K₂O were applied alone and in all combinations. In 1951, each plot was split with a factorial of 0 and 60 pounds per acre of P₂O₅ and K₂O. Determinations of yield, botanical composition, and chemical composition of the hay were made. Soil analyses were made to determine depth distribution of available nutrients in the soil. The soil was very low in "available" phosphorus and potassium and large increases were obtained from fertilizer applications. There was

competition between the alfalfa and timothy for both phosphorus and potassium. Alfalfa was the dominant competitor for phosphorus while timothy offered the most competition for potassium.

Very efficient recovery of the topdressed phosphorus was indicated. The apparent recovery of applied potassium was as high as 100 percent from several treatments. The chemical data indicate that even the maximum application of 180 pounds of K₂O per acre in the 2 years was not sufficient for maximum yield on this very potassium deficient soil. Soil tests at the end of the experiment indicate a considerable increase in "available" phosphorus in the surface layer from applications of 120 pounds or more per acre of P₂O₅. The residual effect of potassium could not be detected by soil tests.

INFLUENCE OF FERTILIZERS ON THE CRUDE PROTEIN YIELDS OF BROMEGRASS PASTURE IN THE MATANUSKA VALLEY

By W. M. Laughlin. Soil Sci. Soc. Amer. Proc. 17: 372-374. 1953.

Crude protein yields of bromegrass pasture were markedly increased by nitrogen fertilizers. This conclusion is based on field trials in the Matanuska Valley of Alaska during 1949, 1950, and 1951. A split-plot factorial design was used to compare 5 rates of nitrogen fertilization, spring versus summer nitrogen applications, and 3 levels of phosphate-and-potash applied in a fixed ratio. Each increment of nitrogen, including the highest level (128 pounds of nitrogen per acre) produced highly significant increases in protein yields. Greatest production amounted to 636 pounds of crude protein per acre as compared to unfertilized plots which produced only 100 pounds. Sixfold increases were obtained from heavy fertilization which is economically feasible under present conditions.

Significant nitrogen X phosphate-potash interactions were observed. Early season protein yields are usually increased by phosphate-potash applications while later clippings are generally not benefitted. Stage of maturity when grazed also determines crude protein yields which are the greatest during the early flowering stage.

A STUDY OF PHOSPHATE FERTILIZATION AND LEGUME ROTATIONS FOR SMALL-GRAIN WINTER PASTURES

By H. J. Harper. Okla. Agr. Expt. Sta. Bul. 414. 1953.

This is a report of a study conducted to determine the grazing value of winter small-grain pasture and whether it could be increased by soil improvement practices.

Forage production and the amount of protein feed could be doubled or tripled by proper fertilization and growth of a soil-building legume once in every 3 or 4 years. More forage and protein were produced in 4 years when sweetclover was grown one of the years than when wheat was

planted every year. Planting the grain in 14-inch rows as compared with 7-inch drill rows increased the forage yield of rye and of wheat planted following a summer crop of lespedeza.

BETTER CATTLE DISTRIBUTION THROUGH THE USE OF MEAL-SALT MIX

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By F. N. Ares. Jour. Range Mangt. 6: 341-346. 1953.

Trials conducted in New Mexico show that outstation feeding of meal-salt ration can be used as an effective tool for obtaining more uniform grazing use of the range by cattle. In these self-feeding tests, the supplement was placed at and away from water in one pasture and away from water only in a second. The feeding method was reversed in the test pastures the second year.

Results of the 2-year test show a marked improvement in the use pattern with outstation feeding. The proper-use zone of the test pastures was increased 84 percent while the too heavily used zones near water were reduced 52 percent. The lightly used area was reduced by 26 percent.

Tree Fruits and Nuts

HEAVY-METAL NUTRITION IN RELATION TO IRON CHLOROSIS OF CITRUS SEEDLINGS

By P. F. Smith and A. W. Specht. Fla. State Hort. Soc. Proc. 65: 101-108. 1952.

The results seem to support the idea that the main cause of the recent increase in acid-soil chlorosis in Florida citrus groves is the accumulation of copper in the soil.

DEPLETION OF SOIL MOISTURE IN A MATURE APPLE ORCHARD WITH A SOD-MULCH SYSTEM OF SOIL MANAGEMENT

By A. L. Kenworthy. Mich. Agr. Expt. Sta. Quart. Bul. 36: 37-43. 1953.

Root development of apple trees as a result of mulching was increased in the soil mass covered by the mulch material. Apparently, the roots of the trees are concentrated in the soil covered by the mulch material and do not extend appreciably beyond the mulched area.

Root penetration appeared to be improved by the mulch, as indicated by the uniform depletion of soil moisture at all depths. The amount of available soil moisture early in the season was greater beneath the trees (the mulched area) than at the edge of or between the trees.

IRON CHLOROSIS IN FLORIDA CITRUS GROVES IN RELATION TO CERTAIN SOIL CONSTITUENTS

By W. Reuther and P. F. Smith. Fla. State Hort. Soc. Proc. 65: 62-69. 1952.

Data are summarized from analysis of more than 200 soil samples, of which 21 virgin soils and the

rest were commercial grove locations. The elements copper, manganese, iron, and phosphorus were assayed. The objective of the study was to survey the total content of these elements in Florida grove soils in relation to tree age, soil type, and incidence of iron chlorosis.

Mature groves have accumulated relatively high concentrations of total copper, manganese, and phosphorus in the topsoil. In general, groves affected with iron chlorosis are likely to have a somewhat higher level of these elements in the soil than do healthy groves and a somewhat lower level of total iron.

Vegetable Crops

RESPONSE OF VEGETABLE CROPS TO SOIL CONDITIONERS

By R. E. Wester. Agr. Chemicals 8: 48-50+. 1953.

The effects are reported of Krilium No. 6 on growth and yield of early broccoli, cabbage, lettuce, and tomatoes; the effects of Aerotil, Krilium No. 6, and Krilium No. 9 on yield of late tomatoes; and the visible effects of these conditioners on structure of Sassafras silt loam. Plants for transplanting into treated soils were grown in flats of treated soil.

Control plots were transplanted with plants grown in flats of nontreated soil. These synthetic soil conditioners proved practical and economical for use in potting soil and for hill placement in home-garden plots.

EFFECT OF FERTILIZERS ON THE YIELD AND GRADE OF ONIONS

By H. W. Gausman, W. R. Cowley, P. W. Leeper and R. T. Correa. Tex. Agr. Expt. Sta. Prog. Rpt. 1603. 1953.

According to the results of this experiment, onions responded significantly to applications of N, P₂O₅, and K₂O. The highest yield and also the highest percentage of marketable onions resulted from a 240-100-100 fertilizer treatment, of which 40 pounds of nitrogen were applied as a side-dressing.

PHOSPHORUS REQUIREMENTS OF TRANSPLANTED TOMATOES ON HEAVY SOILS

By C. Y. Arnold. Soil Sci. 76: 405-419. 1953.

This paper reports results of a series of field trials in which the response of transplanted tomatoes to phosphorus fertilizer at several phosphorus fertility levels were studied. Equations describing this response permit estimation of the percentage yield that can be obtained from combinations of available soil forms, broadcast superphosphate, and phosphorus in the transplanting water.

It was also shown that these equations could be used in conjunction with certain economic factors to indicate the most profitable rate of phosphorus fertilizer applications.

Weed, Brush and Pest Control

CHEMICAL CONTROL OF BUTTERCUP ON MOUNTAIN MEADOWS

By D. R. Cornelius and C. A. Graham. Jour. Forestry. 51: 631-634. 1953.

Tests conducted on a mountain meadow showed that plantain leaf buttercup is susceptible to the selective herbicide 2, 4-D.

RESISTANCE OF DDT IN SOILS OF THE AREA INFESTED BY THE JAPANESE BEETLE

By W. E. Fleming and W. W. Maines. Jour. Econ. Entom. 46: 445-449. 1953.

The average residual DDT in the soils treated at the rate of 25 pounds per acre was as follows: 1 year, 97 percent; 2 years, 90 percent; 3 years, 79 percent; 4 years, 64 percent; 6 years, 56 percent; and 8 years, 44 percent. With a 50-pound treatment, the loss was much the same.

EFFECT OF 2, 4-D ON THE NITRATE CONTENT OF FORAGE CROPS AND WEEDS

By R. T. Bery and L. W. McElroy. Canad. Jour. Agr. Sci. 33: 354-358. 1953.

Forage plants and weeds were treated with 2, 4-D and nitrate determinations were made on samples from treated and check plots. All samples of oats contained high levels of nitrate but no evidence of an effect of treatment with 2, 4-D on nitrate content was found in oats, brome grass, timothy, alfalfa, red clover, sweetclover, or white Dutch clover.

Relatively high concentrations of nitrate were found in Canada thistle, dandelion, lamb's quarters, redroot pigweed, Russian pigweed, and Russian thistle. The nitrate content of Russian pigweed and Canada thistle samples taken from treated plots was significantly higher than samples of these weeds taken from check plots.

Forestry, Woodlots, Shelterbelts

SOIL-VEGETATION SURVEYS OF WILDLANDS

By J. L. Retzer. Jour. Forestry. 51: 615-619. 1953.

Research has demonstrated that soil-vegetation surveys are feasible and can be readily made for wildlands. Soils vary widely in mountainous lands and have a very important effect on the use potentials of sites. Soil-vegetation maps are concise reports which show the basic differences in soils and the areal extent of each important unit.

ESTIMATING SUMMER EVAPOTRANSPIRATION LOSSES IN A PENNSYLVANIA SCRUB OAK FOREST.

By N. Bethlahmy. Soil Sci. Soc. Amer. Proc. 17: 295-297. 1953.

To determine evapotranspiration losses, daily soil-moisture losses were analyzed for periods

during the summer months when the soil was at or below field capacity. These losses were then related to several factors. Atmospheric saturation deficit was the only climatic element that was statistically related to evapotranspiration losses. Other climatic elements studied bore no relation to the soil-moisture losses.

In addition, soil-moisture content and length of time elapsed since a storm had no relation to these losses. Further analysis revealed that evapotranspiration losses start at a minimum saturation deficit of approximately 0.020 inch of mercury, and that the value of the saturation deficit regression coefficient is directly related to the total sand content in the soil profile.

MAGNESIUM DEFICIENCY OF SOME NORTHEASTERN PINES

By E. L. Stone, Jr. Soil Sci. Soc. Amer. Proc. 17: 297-300. 1953.

Magnesium deficiency was studied in young forest plantations on light-textured soils bordering the western and southwestern margins of the Adirondack province of New York. Conspicuous symptom of deficiency was a bright yellow discoloration of the tips of the current season's needles. When the deficiency was severe the chlorosis was followed by death of the needle tips or premature loss of foliage.

Gross reductions in shoot growth and needle length occurred only under extreme deficiency or when lack of magnesium was accompanied by potassium deficiency. Fertilization of deficient trees with magnesium sulfate resulted in increased height growth over a period of at least 3 years. In two instances this increase was shown to be additive to that due to potassium, without evidence of significant interaction.

A THINNING STUDY IN FLATWOODS LONGLEAF PINE

By T. C. Evans and G. F. Gruschow. Jour. Forestry. 52: 940. 1954.

The data presented here are of interest chiefly as they reflect the basic relation between stand density and growth rate per acre and thinnings of pulpwood. Precommercial thinnings do not appear to be justified in longleaf pine, particularly in view of the early expression of dominance which characterizes this species.

The data further suggest that where fairly wide spacing is used to favor gum yields and forage production, the sacrifice in wood volume production of longleaf pine on these soils may be less than is generally supposed.

